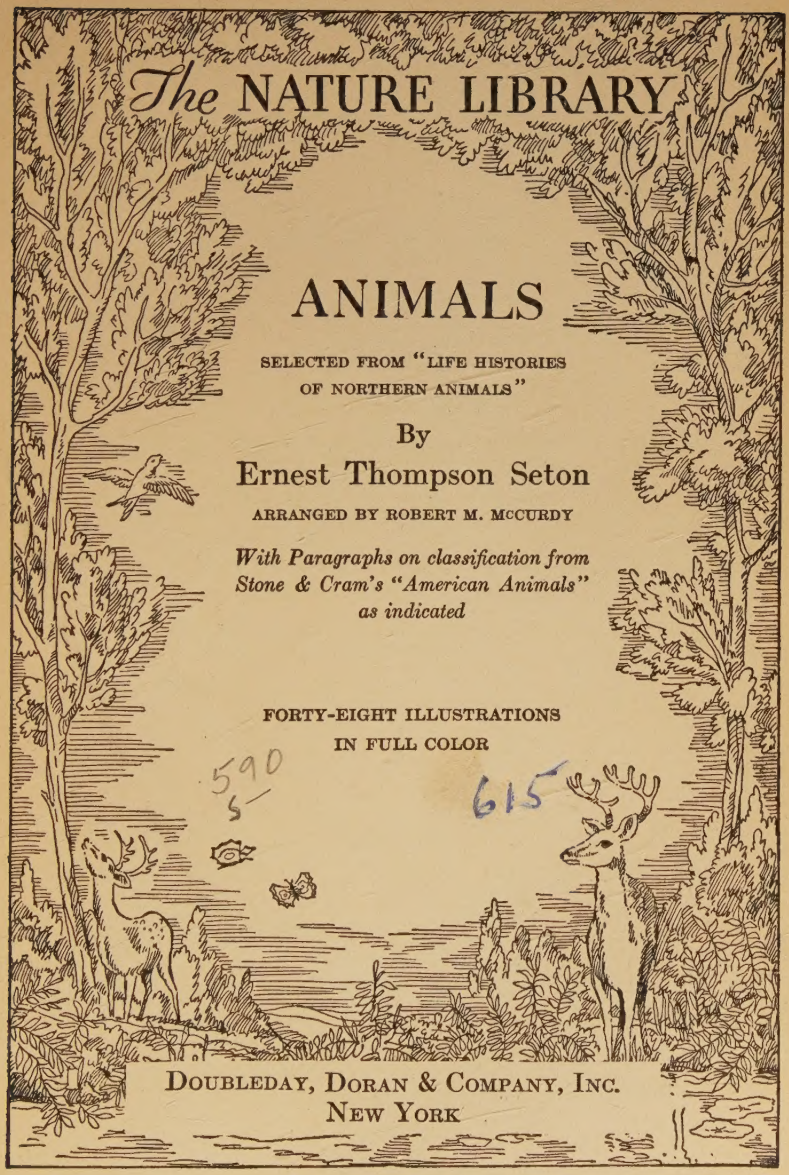
THE NATURE LIBRARY

TRINITY METHODIST CHURCH

ANIMALS

TRINITY METHODIST CHURCH



The NATURE LIBRARY

ANIMALS

SELECTED FROM "LIFE HISTORIES OF NORTHERN ANIMALS"

By

Ernest Thompson Seton

ARRANGED BY ROBERT M. McCURDY

With Paragraphs on classification from Stone & Cram's "American Animals" as indicated

FORTY-EIGHT ILLUSTRATIONS IN FULL COLOR

590
S
615

DOUBLEDAY, DORAN & COMPANY, INC.
NEW YORK

CL

COPYRIGHT, 1909, 1925, 1926, BY ERNEST THOMPSON SETON. ALL RIGHTS RESERVED.
PRINTED IN THE UNITED STATES AT THE COUNTRY LIFE PRESS, GARDEN CITY, N. Y.

CONTENTS

PART I

UNGULATA

(Hoofed Animals)

		PAGE
I.	DEER AND THEIR ALLIES	3
	I. AMERICAN ELK	3
	II. VIRGINIA DEER	9
	III. MULE DEER	18
	IV. MOOSE	23
	V. WOODLAND CARIBOU (*American Reindeer*)	31
II.	PRONG-HORNS	36
	AMERICAN PRONG-HORN	36
III.	THE CATTLE	44
	I. MOUNTAIN SHEEP	44
	II. AMERICAN BISON OR BUFFALO	47
	III. MOUNTAIN GOAT	56

PART II

GLIRES

(Gnawing Animals)

I.	SQUIRRELS AND MARMOTS	64
	I. RED SQUIRREL	64
	II. GRAY SQUIRREL	69
	III. CHIPMUNK	72
	IV. LITTLE CHIPMUNK, LONG-TAILED CHIPMUNK	77

SQUIRRELS AND MARMOTS (*continued*) PAGE

V. FRANKLIN GROUND-SQUIRREL, RICHARDSON GROUND-SQUIRREL 79
VI. STRIPED GROUND-SQUIRREL 83
VII. FLYING SQUIRREL 87
VIII. WOODCHUCK 89
IX. PRAIRIE DOG 94

II. BEAVERS 96
CANADIAN BEAVER 96

III. RATS, MICE, AND LEMMINGS 103
I. HOUSE MOUSE 104
II. NORWAY RAT 104
III. GRASSHOPPER MOUSE 106
IV. ARCTIC DEER MOUSE, PRAIRIE DEER MOUSE 108
V. RED-BACKED MOUSE 111
VI. MEADOW MOUSE 113
VII. MUSKRAT 116

IV. POCKET GOPHERS 120

V. JUMPING MICE 125

VI. PORCUPINE 130
CANADA PORCUPINE 130

VII. RABBITS AND HARES 135
I. SNOWSHOE RABBIT 135
II. COTTONTAIL 140
III. PRAIRIE HARE 141

PART III

CARNIVORA

(Flesh-eaters)

I. EARED SEALS 150
FUR SEAL 150

II. SEALS 154
HARBOR SEAL. 154

PAGE

III. THE CATS 157
I. CANADA LYNX 157
II. COUGAR 161
III. MEXICAN JAGUAR 166
IV. OCELOT 167

IV. THE DOG 168
I. KIT FOX 168
II. RED FOX 169
III. GRAY WOLF 176
IV. COYOTE 183

V. WEASELS, OTTER, ETC. 189
I. OTTER 189
II. WEASEL 194
III. MINK 200
IV. MARTEN 205
V. FISHER 210
VI. WOLVERINE 213
VII. SKUNK 217
VIII. AMERICAN BADGER 223

VI. RACCOONS 227

VII. BEARS 232
I. GRIZZLY BEAR 232
II. BLACK BEAR 236

PART IV

INSECTIVORA

(Burrowing Animals)

I. SHREWS 248
I. COMMON SHREW 248
II. MARSH SHREW 252
III. SHORT-TAILED SHREW 253

II. MOLES 258
I. COMMON MOLE 258
II. STAR-NOSED MOLE 260

PART V

CHIROPTERA

(Flying Animals)

PAGE

I. BATS 266
I. LITTLE BROWN BAT 266
II. SILVER-HAIRED BAT 270
III. LARGE BROWN BAT 272
IV. RED BAT 274
V. HOARY BAT 277

PART VI

MARSUPIALIA

(Pouched Animals)

I. OPOSSUMS 285
I. VIRGINIA OPOSSUM 285
INDEX 293
BOOKS BY ERNEST THOMPSON SETON 295

LIST OF ILLUSTRATIONS

Elk Virginia Deer		*Frontis*
		FACING PAGE
Moose		10
Mule Deer		11
Caribou		30
Antelope		31
Mountain Sheep		46
Bison		47
Mountain Goat		66
Red Squirrel		67
Squirrel		74
Chipmunk		75
Gopher		78
Flying Squirrel		79
Prairie Dog		94
Woodchuck		95
Beaver		110
Muskrat		111
Porcupine		126
Snowshoe Rabbit		127
Cottontail Rabbit		142
Jack Rabbit		143

FACING PAGE

Sea Lion 158
Seal 159
Lynx 162
Bobcat 163
Mountain Lion 170
Jaguar 171
Ocelot 174
Fox 175
Silver Fox 178
Gray Wolf 179
Coyote 186
Otter 187
Weasel 190
Mink 191
Marten 194
Fisher, Black Cat 195
Wolverine 202
Skunk 203
Badger 226
Raccoon 227
Grizzly Bear 234
Black Bear 235
Common Shrew 254
Mole 255
Brown Bat 270
Opossum 271

INTRODUCTION: CLASS MAMMALIA
(S. & C.)*

COMPLICATED, detailed classification is inappropriate in a volume of the size and scope of the "Nature Series," but it is desirable to understand in a brief general way the position in the zoölogical world of the animals whose life history will occupy the following pages.

The division of vertebrates (backboned animals) is among the most important of the first broad general classifications of the animal world, including man and other mammals, birds, amphibians, fish, and reptiles. Subdividing again we reach the CLASS MAMMALIA.

The most important characteristic of mammals, one not possessed by any other animals, is that the young are nourished for some time after birth on milk secreted by the mother. Mammals are also mostly covered with hair in distinction to the feathers of birds and the scales of fishes and reptiles.

Mammals are supposed to have originated from some early reptilian animal and branched off long before the birds were evolved. In some cases fossil remains allow us to trace without difficulty the progress of many modern representatives. The horse, for instance, is clearly shown to be descended from a five-toed beast which ages of specialization have brought down to a horse of four and then of three toes.

*The initials "S. & C." underneath a head indicate that the source of information in all the paragraphs under that head is Messrs. Stone & Cram's book, "American Animals." After a paragraph the initials indicate the same source. —EDITOR.

Dividing the mammals again, we come to two groups, the *Eutheria*, which includes most of the animals mentioned in this volume; and the group known as *Prototheria*, comprising certain Australian animals which represent surviving relics of early fossil forms.

Disregarding certain obscure animals not early classified, we arrive finally at the following arrangement of *Eutheria*:

Cetacea (whales)
Sirenia (manatees)
Edentata (sloths, armadillos, etc.)
Glires (rats, mice, etc.)
Chiroptera (bats)
Insectivora (shrews, etc.)
Carnivora (cats, dogs, etc.)
Proboscidea (elephants)
Ungulata (horses, cows, etc.)
Primates (monkeys, man)
Marsupialia (kangaroos, opossums, etc.)

Certain of these divisions are not found in continental North America, and others are so meagrely represented as to be outside the scope of the volume.

Scientists catalogue and separate into still further classifications these various groups, dividing by differences of structure and then again by differences of color and habit caused by various geographical changes. Skull and teeth are studied with care and may prove animals, alike externally, to be of entirely different species. The bones of hands and feet are markedly different in various species.

The relations between man and the lower mammals

have always been most important. Man depends upon the animals for food and clothing and for transportation. Man's attitude (except toward such animals as he desired to domesticate for his own purposes) has always been that of a destroyer. Some he destroys necessarily for food or for valuable skins; others for the pure love of the chase. Greed and wantonness have brought to almost absolute extinction many valuable and interesting mammals whom moderate protection would have preserved probably for all time.

Yet why read about animals that nowadays can be seen only in a zoo? In the first place, we can hardly pick up any printed volume of colonial days, whether history, or travel, or fiction, without some, often many, references to animals predacious or otherwise.

In the second place, the wild animals are really more plentiful than is commonly supposed. Our four-footed friends are largely nocturnal and their extreme wariness makes them difficult to discover. In country districts after a snowfall there may be an astonishing array of animal tracks. In the fresh snow may be discerned perhaps the sharp, clear-cut trail of the fox, certainly the blurred mark of the rabbit's hairy foot, the nervous tread of the squirrel, the dainty traceries of the mice and shrews.

The woodsman understands these signs which are passed indifferently by the uninformed. A knowledge of wild animals doubles the interest of an ordinary country ramble. Though one may see no more than a few squirrels, a mouse or two, perhaps a rabbit, muskrat, or woodchuck, we learn to know of their presence and see their work on every side. *And the more we learn their ways, the more glimpses we will likely get of them!*

PART I

UNGULATA

(HOOFED ANIMALS)

ANIMALS

UNGULATA
(HOOFED ANIMALS)
(S. & C.)

To the order UNGULATA, or hoofed animals, belong most of our largest mammals. Nearly all the "game" animals are ungulates, as are also the domestic animals, the horse, cow, ass, sheep, goat, and hog.

Animals of this order are herbivorous, and many are gregarious, associating in large herds. In structure they differ from all the other orders in the possession of rounded horny hoofs which terminate the toes and correspond to the claws of the rodents and carnivores. Members of this order are digitigrade, walking on the tips of the toes with the heel much elevated. In most species the legs are decidedly long and the feet much elongated.

The deer and their allies constitute the section of ruminants—to which also domestic cattle belong—which are characterized by a peculiar four-parted stomach and the habit of casting up the hastily cropped grass for further mastication later on. Canine teeth are often lacking, but the large grinders or molar teeth are always present. Most of the ruminants are also peculiar in the possession

of horns or bony antlers growing out from the top of the skull.

To-day our native ungulates are few in number compared with the numbers shown by fossil remains to have existed in time past. They are grouped in four families: Family *Dicotylidae*, peccaries, pig-like animals not ruminant and without horns; Family *Cervidae*, deer, elk, etc.; Family *Antilocapridae*, the pronghorn; and Family *Bovidae*, cattle and their allies.

I

DEER AND THEIR ALLIES

Family *Cervidae*

To this family belong the majority of our American hoofed animals. Their most distinctive characteristic lies in their solid horns or antlers which are shed once a year. The new horn grows rapidly and is for a time soft, full of blood vessels, and provided with a downy covering known as the "velvet." When the full growth is attained the horn becomes hard and the velvet wears off. The first antlers are very simple, but each succeeding pair is, as a rule, more and more branched so that a large number of "points" indicates to the hunter an old individual.

—(S. & C.)

I. American Elk

Cervus canadensis (Erxleben)

(Also called *Wapiti*)

Length—8 feet. *Height at shoulder:* 5 feet 4 inches. *Length of antler:* 50–65 inches.—(S. & C.)

Description—Body above yellowish brown, beneath nearly black; head, chest, and neck dark brown; legs clove brown; a yellowish white area on the rump about the base of the tail. Female rather lighter colored. The antlers borne only by the male curve outward and backward with curved branches, or tines, projecting

forward at nearly uniform distances. The lowest pair directly over the forehead.—(S. & C.)

Weight—An average bull at full growth will weigh about 700 pounds, a cow under similar conditions 500 pounds, and a new-born fawn or calf probably 30 pounds.

Range—Formerly throughout the Northern States and Canada, extending southward in the mountains. Now nearly extinct in the East.—(S. & C.)

Wapiti is the Indian name and far more distinctive, as the word elk is also applied to the moose. Of this "great stagge" mentioned in early accounts of travel, of which there may have been at the time of the discovery of the continent ten million head ranging over the two and a half million miles appropriate to its life and development, there remained, according to an estimate in 1907, no more than 50,000 existing. Of this remnant some 25,000 were estimated to be in the Yellowstone Park and vicinity and the rest in the northern and more inaccessible parts of Canada. To-day with game laws and adequate protection there is no doubt but that the wapiti are slowly increasing. It is certain that with a system of permanent safe havens, proper limitation of bags, and an absolute prohibition of repeating rifles and of the sale of game, we may keep these native animals with us as long as we have wild land for them to range on—that is, for ever.

There are four forms of wapiti recognized:

canadensis Erxl., the typical form.

occidentalis H. Smith, the very dark wapiti of the Olympics and West Coast.

merriami Nelson, paler and more reddish than the typical forms.

nannodes Merriam, the very pale and dwarfed wapiti of southern California.

In 1535 Jacques Cartier, after his return from his ascent of the St. Lawrence as far as what is now Montreal, reported "great stores of stags, deere, beares." In Captain George Weymouth's "Voyage to Virginia" (1605) occurs the first printed use of the word "Olkes." Not for two centuries later does the word wapiti, an Indian name of the Shawnees, appear in print.

The beginning of the nineteenth century saw the wapiti perfectly described, catalogued, and already started on the road to extermination. Even at that time in eastern America travelers could record only the reminiscences of old settlers or the discovery of fossil horns and skulls. In the far West the dwindling process went on steadily up to the 'nineties.

The great haven of the Rocky Mountain elk is the Yellowstone Park, and it is through observation of the bands gathered there that our present information, still somewhat incomplete, is largely derived.

As the snow melts, the elk bands wend their way northward from the lower winter ranges along the Snake River and other streams. The cows remain in the rich upper valleys, the bulls seek pasturage still farther up. Late in May or early in June the fawns are born, usually one to a mother, in some quiet hollow away from the herd. For a few days, though for a shorter time than with most sorts of deer, they are left concealed in the bushes. None can see them without marveling at their stillness. They pretend to be logs, lumps, dead things, but all their pretty conceit is belied by the bright, unblinking eyes that take

in every movement of whoever happens to see them. The white spots are a valuable piece of protective coloration much like the dappling spots of sunlight glancing through foliage on a log or ground below.

For some days the calf is thus hidden. Even after it is old enough to follow the mother she will hide it on the appearance of danger. How it is made to understand the danger, whether by signal from the mother or by sighting the menace, is a point naturalists have never been able to determine.

By September the spots on the fawns have become much faded, and in October, with the new coats, they usually disappear. The young are now able to forage for themselves.

The curious but well-authenticated social amusements of the elk, particularly what is called their "circle dance," are very interesting, but detailed description would exceed the limits of our space.

As the elk is the most polygamous of all deer (in America and probably in the world) it is interesting to note that it is the first of the family to disappear before civilization. It is also remarkable that the white-tail, the most successful of our common deer, is the least polygamous. Contrary to the popular and widespread belief, an elderly female and not a big bull will be generally found to be the leader of the wapiti herd.

The crowning glory of the stag is his antlers, and the wapiti, the finest stag in the world, has antlers befitting his size and dignity. About the end of winter the antlers of the year break off flush with their horny base an inch or more above the skull. At first the place of each antler is a broad raw spot. A few days later it shows

a thick rounded pad of blood-gorged skin. This swells rapidly, and in a fortnight the great, bulbous, fuzzy young antler has shot up to a height of several inches. In a month the structure is a foot high and in four months, by August, the building is done. Slowly now the supplies of blood at the base of the antler are reduced. Presently the sensitiveness leaves each part, the velvet covering dries and peels. The stag assists the process by scraping his new antlers on the brushwood. September sees him fully armed, glorying in his weapons and strength, ready to do battle with all comers. All antlers are a reflection of the owner's age and his vicissitudes while he was growing them. A stag too young or too old produces antlers which are below standard. Hurts and mishaps of all sorts are reflected in the structure and hint at stories the human observer can never know.

The autumn in his years of perfect prime is the crowning epoch of the great stag's life. Then from the mountain whither he retired last spring he descends to the level of the cows. He is now fat and well favored. A new blue coat has replaced his rusty brown. His neck is swollen, his muscles tense, he is tingling with life and vigor. Above all, his antlers are perfect, new grown, clean, sharp, and heavier now than they will be later. A new feeling comes over both sexes: first in the bull, with overwhelming power; next in the cow with lesser force.

Filled with courage, proud of his horns, conscious of his strength, this greatest bull of the valley gets himself upon some commanding ridge, fills his lungs, and raising his muzzle, pours forth a tremendous guttural roaring that rises in pitch to trumpet tones, higher and higher, till it breaks into a shrill, piercing whistle, then fades and drops

again to the guttural, concluding with a few savage grunts. This is the world-famed bugling of the elk, the most inspiring music in nature. Soon the distant woods give forth reply, the bugled answer of some other knight, one perhaps with many possessions in the form of wives at stake or perhaps a youngster just coming into his strength, with nothing to risk but life and limb, with his fortune to make and spoiling for his chance.

The deep bugle notes are characteristic of the animal in his prime. Young bulls are often called "squealers" and being more numerous are responsible for the bugling being called "whistling."

Every sportsman and naturalist has wished to see a real wapiti duel, but few have been fortunate enough to have their desires realized. We quote with much abridgment from the description of W. A. Baillie-Grohman, the well-known sportsman:

. . . I kept at a respectful distance, some twenty or thirty yards from cover. . . . For several minutes at a time the antlers appeared inextricably locked together and as one of the stags seemed the stronger, though not the more agile of the two, superior weight would in those moments enable the heavier animal to fling his adversary from side to side, without, however, being able to free his own horns wherewith to do grievous injury to his foe. Before long one was on his knees, pressed down, apparently by main force; then the other staggering back would for a brief moment halt . . . but the foe was on his legs again, antler crashed against antler with a force that seemed irresistible . . . the combatants moved about the meadow much as expert boxers would, though after a quarter of an hour's fighting weight had told its tale, the smaller stag had to retreat more frequently than ever, the adversaries were

fast approaching the edge of the forest at the latter's back. Here a last stand was made . . . and here the repulsed one received his death wound. The wounded hart fled to the forest where I found him next morning dead, with a ghastly slash that had ripped open his side and penetrated his vitals.

But there may be another finish to the combat. The knights have clashed together, the strong and springy antlers have yielded a little under shock of onset, but sprung together locked—locked so firmly that now there is no fencing, nothing but pushing and wrestling. Try as he may, neither can wrench himself free. Strong and weak alike are now face to face with lingering death. Many a time have two carcasses been seen thus antler bound. More than once the first to die has been partly eaten by wolves which the other feebly struggled to avoid.

Hunters often chance on the records and proofs of ancient battles. Wolves have picked the frames but the peeling skulls are there, with the two great pairs of branching gear inextricably locked and gripped and interlocked. One can trace the tragic end in the harrowed earth and one can picture the scurrying herd of cows driven away by a lesser bull who has inherited what his betters have battled for in vain.

II. Virginia Deer

Odocoileus virginianus (Boddaert)

Length—6 feet. *Height at shoulder:* 3 feet 1 inch. *Length of antler:* 20–24 inches.—(S. & C.)

Description—Bright rufous chestnut above in summer with a black band on the chin and throat; under parts and inside of legs white; tail brownish above, white beneath.

In winter the upper parts are yellowish gray with white about the eye. Antlers curving outward and then upward, the tips curving in again toward one another. There is a short upright spike near the base beyond which the beam gives off two upright branches making three nearly equal prongs. At no point does the antler branch dichotomously.—(S. & C.)

Weight—Bucks of 300 pounds are killed every year in the Adirondacks, but 200 pounds will perhaps be considered an average weight. The smallest species are quite likely not to weigh more than thirty or forty pounds. A full-grown Adirondack doe will weigh in the neighborhood of 150 pounds.

Range—Eastern North America separable into several geographical varieties and represented westward to the Pacific by other closely related races.—(S. & C.)

The Northern white-tail is much larger than the typical form from Virginia, being nearly double in weight; the white-tail group present a complete gradation in size from the pigmy Acapulco of Mexico, the Florida deer a little larger, increasing to the giant forms of Maine and Manitoba. The sportsman-hunter usually lumps the twenty-odd species and races of small American deer as "deer" and pays little attention to the directive marks in which scientists found races and species. The simplest method of identification is to remember that the tail and disk are totally different in each species. If every sportsman would bring the tail of his deer with a note of its length and the locality where he found it the species should be determined with fair certainty.

The white-tail is with reason called the Virginia deer

because, though there is little doubt that Cartier saw this swiftest and shyest of creatures at Montreal in 1535, the first positive identification is by Thomas Hariot, an English mathematician, in the service of Sir Walter Raleigh, who visited Virginia in 1584. After commenting on the "Deare" he remarks: "They differ from ours only in this, their tailes are longer and the snags of their hornes look backwards."

No doubt at this time the white-tail was to be found in all sections of the country that were appropriate to it. White-tails are essentially creatures of the denser woods and of thickets where denser woods alternate with open glades. Bare plains and rugged hillsides the creature avoids; but every Western river with far-reaching scrubby thickets is sure to carry a few skulking deer which, between scrub and bog, are able to hold their own and multiply in spite of rifle and wolf.

A study of the careful records maintained of the migrations of wild animals shows the interesting fact that whereas the species has lost much territory in the East, it has gained enormously in the North and West. Deer undoubtedly prefer the edges of civilization. There man wars on its foes, the wolves; there his axe makes sunny openings in the fir gloom; and there man grows crops that furnish delectable food in times of scarcity.

Yet though the range of the species has advanced with the settlers, the home range of the individual is thought to be very small, smaller probably than that of any other of the deer family in America. A moose or a mule black-tail may pass the whole of a summer on a square mile. According to Audubon and Bachman, "a white-tail is usually found in the same range or drive, as it is called,

and often not fifty yards from the place where it was started before." In the Rockies two or three hundred acres will often provide a sufficient homeland for a whole family of white-tails the year round.

The map of to-day shows a wide but sparse distribution, with general figures of somewhere about 500,000 white-tail for the entire population north of the Rio Grande. The Adirondacks, northern New England, northeastern Texas, and the dry parts of Florida (an aggregate of 100,000 square miles) may yet show an average of three deer to the square mile. But the species is now practically absent over some 600,000 square miles which was formerly considered its best territory, and other sections are so sparsely supplied that one deer to five square miles will be a liberal estimate. The state of Maine is thought to have now one fifth of the deer in the country.

In general style the coast deer antlers resemble those of the mule-deer, but are more slender. A pair with many snags *probably* belongs to an old buck and yet again an old buck may have mere spikes. Any one pretending to tell the age of a buck by the horns alone is sure to err. The record for points still rests with a pair owned by Albert Friedrich of San Antonio, Texas, which are of such abundant vigor as to have 78 points. A 42-pointer from the Adirondacks and a 35-pointer from Minnesota claim second and third places respectively. Antlers are sexual appendages and their connection with the genital system is close though obscure.

Hariot first called attention to the unique fact that the "snags" of the horns "look backwards." This peculiarity has one great disadvantage, and more in the white-tails than in any other in America do we find cases of

fatally interlocked antlers—cases in which two bucks struggling for the mastery have either sprung their antlers apart or forced them together so that they are inextricably intertangled and death to both is the inevitable finish. Often death comes by starvation so that antler-bound bucks are lucky if found by their natural enemies and put to a speedier and more merciful death.

The hearing and scent of deer are marvellously acute, but their eyesight is not of the best. The deer seems to regard all motionless objects down wind as mere features of the landscape. Hunters take advantage of this weakness when stalking in the open. They run toward the deer without concealment as long as it is grazing, but the moment it shows, by shaking its tail, that it is about to raise its head, they "freeze," crouching low and still. The deer takes its customary look around and lowers its head to feed again, whereupon the hunters repeat the open approach, and thus continue until within easy shot. Col. Theodore Roosevelt observes that "the eyesight of the white-tail as compared with that of the pronghorn antelope is poor. It notes whatever is in motion, but it seems unable to distinguish clearly anything that is not in motion."

The deer is generally considered a very silent animal, yet the list of its noises increases with fuller observation. According to Audubon and Bachman: "The fawn has a gentle bleat that might be heard by the keen ears of its mother at the distance, probably, of 100 yards. We have never heard the voice of the female beyond a mere murmur when calling her young, except when shot, when she often bleats like a calf in pain. The buck when suddenly startled sometimes utters a snort, and we have at night heard him emitting a shrill whistling sound, not unlike that of

a chamois in the Alps, that could be heard a distance of half a mile."

The greatest enemy of the white-tail is the buckshot gun, with its confederates, the jacklight and canoe. Next comes the repeating rifle of the poacher and pothunter. The third enemy is deep snow. Deep snow hides their food, robs them of their speed, brings them easily within the power of the cougar.

Wolves rank high in the list of the white-tail's foes. On the upper Ottawa the deer came in with the settlers. The wolves followed because in the deer they found their winter support. Winter robbed the deer of the safety of the countless lakes and the wolves could run them down. If we could exterminate the gray wolf, we should half solve the question of deer supply; but there is no evidence that we shall ever succeed in doing this.

It seems likely that foxes will kill the very young fawns if they find them unprotected. There is at least good evidence that the deer reckon the fox as one of their foes.

Mosquitoes, ticks, and deer-flies are minor annoyances that sometimes assume great importance. Many destructive epidemics are believed to have visited the deer of America from time to time, but authentic scientific knowledge is lacking. The deer cannot fail to suffer injury more or less serious from the blind haste with which they jump through tangled undergrowth and shrubbery.

The ordinary gait is low and smooth bounding with an occasional high jump. The white-tail's bounding at its best is to be estimated at about 27 to 28 miles an hour. The speed with which the animal covers great spaces is marvellous. I have known a buck to clear a four-foot log and fifteen feet of ground in one leap. The occasional

high jump, like the spy-hop of jack-rabbit and springbok, is intended, no doubt, for purpose of observation.

In the water white-tails are very much at home. They can go so fast that a canoe man must race to overtake them; this means that they can swim for a time at four miles an hour. If possible they will make for the water when hunted to extremity. There are many cases on record of deer boldly striking out into the open sea, trusting to luck to find a farther shore.

Let us now begin to follow the life of the doe through the twelve months of the year. On the Northern ranges at least we find that up to the month of January the does and bucks are still in company in the deer-yards. The melting snow sets all free again. The older bucks go off in twos and threes and the does also, accompanied by their young of the year before. New vegetation affords changes of diet from the dry grasses and twigs of winter. Very quickly old and young begin to fatten and grow sleek.

May sees the doe a renovated animal and also sees her alone, for now her six and a half months' gestation is nearing its end. Some day about the middle of the month she slinks quietly into a thick cover, perhaps a fallen tree top, and there gives birth to her young. The number may be one or two or possibly three, according to the age and vigor of the mother.

No North American member of the deer family makes any pretence at a nest. The home is the neighborhood where they are born. They may consider the old tree-top their headquarters, but they will lie in a different part of it every night.

The weight of the fawns at birth is about 4½ pounds. The mother visits them half a dozen times a day to suckle

them. It is probable that save in search of water she never goes out of hearing of their squeak. If found and handled at this time, the fawns instinctively "play dead," are limp, silent, and unresisting.

Their natural enemies are numerous, but the spotted coats of the youngsters and their death-like stillness are wonderful safeguards. Does the mother never forget where she hid her young? How does she come back to the very spot in the unvaried woods?

In the vast majority of cases the mother's memory is sufficient, but it sometimes happens that an enemy forces the little one to run and hide elsewhere while the mother is away. In such cases she sets to work to ransack the neighborhood, searching the ground and wind for a helpful scent, listening intently for any rustle or squeak that may be a fawn. Generally she is successful in her search, but there is evidence that sometimes the end is tragedy; that the fawns, like the children of the story, are lost in the woods.

The moose and the wapiti may hide their young for two or three days, the antelope a week; but the white-tail fawns are usually left in their first covert a month or more. At this age their rich brown coats are set off with pure white spots, making a color scheme that is protective as they crouch in the leaves and is exquisitely beautiful as a little later they begin to bound and glide by their mother's side.

At four or five weeks of age—that is, about the beginning of July—they begin to follow their mother. Their daily lives now are as unvaried as they can make them. They rest in some cool shelter during the morning and about noon they go to their drinking place. As the sun lowers they slip forth to feed by the margin of the forest or near ponds.

When September wanes there are important changes in the youngsters. They are weaned and they shed their spotted coats. They continue to follow the dam, the males for one year, the females for two.

Let us now turn to the year's history of the gentleman of the family. The buck sheds his antlers in January, earlier if very vigorous, weeks later if puny. Surplus energies go to the budding antlers that make their appearance from two to six weeks after the old ones are dropped. The antlers grow with marvellous rapidity. By August they are complete, though still in velvet. By the middle of September the buck has scraped them clean and polished them. They begin to die within three months of reaching maturity. Death begins at the points and follows downward and inward; and it is during the progress of this slow dying that the antlers fill the office for which they were created.

All summer the buck has been living as quietly as the doe, sometimes frequenting the same places but ignoring her if they chance there together. As October approaches his neck begins to swell. Mating instincts are aroused and the bucks begin to seek out the does. As the rutting time in November draws near the necks of the bucks become enormously enlarged, their whole nature seems to change, they become blind and mad with desire, eager and ready to fight any of their own or other kind that seems likely to hinder their search for a mate. The battle of two bucks has been observed and is very interesting.

In mid-December, after the annual sexual climax, the white-tails, good-fellowship resumed, roam, male, females, and young, in bands that are larger than at any other time of the year. Food is plentiful. They fatten quickly,

storing up in their own persons food for the starvation-time ahead.

It is the opinion of all who have studied tame deer that they are more dangerous than tame bears. A bear should be watched, and he has some respect for his friends. A deer is always unsafe for everyone and no man should ever expose himself or his family to the possible treachery of such a pet.

The white-tail is the only one of our deer that can live contentedly and unsuspectedly in a hundred acres of thicket. It is the only one that, hearing a hostile footfall, will sneak around to find the cause, study its trail, and then glide, cat-like, through the brush to a farther haven, without even trying to see the foe who thus gets no chance for a shot. It is the least migratory, the least polygamous, the least roving, as well as the swiftest, keenest, shyest, wisest, most prolific, and most successful of our deer. It is the only one that has added to its range; that in the North and West has actually accompanied the settler into the woods; that has followed afar into newly opened parts of New England and Canada; that has fitted its map to man's, and that can hold its own on the frontier.

The white-tail is the American deer of the past and the American deer of the future.

III. Mule Deer

Odocoileus hemionus (Rafinesque)

(Also called *Black-tailed Deer*)

Length—6 to 7 feet. *Height at shoulder:* 3 feet 4 inches. *Length of antler:* 25–30 inches.—(S. & C.)

Description—Body heavy; ears very large, thickly haired;

tail white with black tip, naked below at the base. Pale dull yellowish in summer, bluish-gray in autumn; front of the face between the eyes dusky, rest of face, throat, abdomen, and inside of legs white. Antlers forking equally (dichotomous) and each prong again bifurcate.—(S. & C.)

Weight—A typical buck will weigh from 200 up to 300 pounds. The females are smaller.

Range—Lower western Canada, North Dakota to Texas and Colorado and west to Washington, Oregon, and northern California. Closely allied varieties occur in California south of San Francisco.—(S. & C.)

When seen alive the mule deer strikes one as a large deer with immense ears and white face which bears a large black patch on the forehead. From behind it shows an angular whitish patch taking in the tail, which has a black tip.

The mule black-tail may be distinguished from the coast black-tail (*O. columbianus*) by the tail which in *columbianus* is tapering from the base, all black above and all white below; and by the metatarsal gland about three inches long on the coast deer and about five inches on the mule deer. The metatarsal gland, again, in the white-tail is commonly no more than an inch long.

The mule deer is essentially a deer of the lower hills or broken ground that is partly wooded. It was first described and named on paper by Lewis and Clark in 1804, and in Manitoba it has long been known as the jumping deer. The total area of black-tail country is 2,500,000 miles and 10,000,000 will be a liberal estimate for the number of deer in primitive times. They were always far

less numerous than the white-tails and much easier to kill. Wholesale slaughter by skin hunters in the 'eighties was fast bringing the black-tail to the point of extinction when game laws came to their aid, and now in Manitoba, the last of their strongholds, the numbers are increasing. In 1908 an estimate of 400,000 of the mule black-tail for continental North America was thought to be not under the facts.

The antlers are what scientists call dichotomous; that is, they are an arrangement of even forks instead of a main branch with snags. This is of course merely the type, from which the variations are endless.

The tail of a deer should always be noticed by the sportsman. Though the coat is changed twice a year, the hair on the tail is shed but once a year in this species and the black switch on the end not at all. The movements of the tail are as characteristic an expression as its form. In bounding away the white-tail holds the banner aloft and waves it from side to side. The mule black-tail carries its tail drooped and swings its black tuft back and forth over the white disk. Both species drop and quiver the tail when they are struck by the hunter's bullet.

The black-tail is migratory in most of its range. Whenever so placed that a journey of one hundred miles will take it from high, bleak, and stormy, to low, warm, and sheltered sections, it fails not to travel in due season, and settle in bands where there is sufficient promise of food and cover. In the Colorado Rockies the deer at the first touch of winter wend their way southward and westward, following well-known, well-worn pathways. After a journey of one hundred to one hundred and fifty miles they reach the open and semi-arid brakes of the Uintah country in

Utah where they will at least eliminate the danger of deep snow.

Following out the course of a year in the life of a black-tail, the mixed company of all ages and sexes begin to disintegrate with the melting of the snow and the prospects of better forage. The does become still less sociable as the May moon wanes and are now to be seen living and feeding alone. In some quiet woodsy hollow in late May or in June the fawns are born, one, two, or more rarely three. The livery is like that of the young white-tail, but the ground color is duller, paler, yellower. The mother hides them usually at different points in the same thicket. In the early morning and evening they are suckled for a period of six or eight weeks before they are allowed to follow her.

By the middle of August the fawns are following their mother and now the spots on their coats have become somewhat dim. So far as is known, the buck takes no interest in the fawns. The number of authenticated cases of bucks killing fawns are probably merely the result of the impatient blow or thrust of a strong animal against anything that gets in its way rather than deliberate murder.

The mating season is at about the same time as that of the white-tail in November, or sometimes later in December. The antlers of the bucks are developed along lines that prevent serious injury in their continual battles which in most cases are little more than pushing bouts.

During winter the black-tails continue, in mixed bands of all ages and sexes, usually under the lead of an old doe who is great-grandmother of most of the band. Their food is twigs, browse, what ground stuff they can get by nosing and pawing under the snow, and what tree stuff

they can reach by standing on their hind legs. The young follow the mother through the winter and spring. When about a year old they leave her probably because she compels them to do so, as an instinctive preparation for the new family.

The deep snow, next after the hunter's rifle, is the worst enemy of the black-tail. Deep snow hides their food, prevents them from moving about, and betrays their presence to a foe that is eagerly awaiting the signs of their footprints, the mountain cougar. In seasons of especially heavy snow cougars all but exterminate bands of these deer which they may come across. Wolves also play havoc with the winter yard, and coyotes, lynxes, and eagles take toll of the young fawns.

The mule deer walks and trots like others of the family, but when it comes to speeding it does not run like the white-tail, but with a peculiar bounding, in which, with small leg movement, it rises as by an effort of the toes, leaping from all four and landing on all four. This action is quite different from the much swifter running of white-tail and antelope.

There is nothing more poetic in four-legged speed than the flight of the bounding black-tail; but these light-foot bounds are not as speedy and not as easy as they look; the black-tail has not the speed or the endurance. The low running of the Eastern deer is a far better gait.

Why, then, these mighty futile bounds? Why, then, has the black-tail not been exterminated since on the level it cannot outrun the swiftest of trailing dogs? Because the black-tail is the deer of broken lands and uplands. Their peculiar bounding pace is their gift, their power, and their hold on life.

IV. Moose

Alces americanus (Jardine)

Length—9 feet. *Height at shoulder:* 5 feet 9 inches to 6 feet 6 inches. *Length of antler:* 41–44 inches.—(S. & C.)

Description—A crest of stiff erect hairs on the neck, much elongated and forming a hump on the shoulders; nose large; the upper lip protruding well over the lower; ears large; tail very short; legs long; a pendent mass of hair on the throat called the "bell." Blackish brown above, grizzled with gray on the rump, shoulders, and sides of the neck; under parts black; inside of legs and their entire lower portions quite gray; feet black; ears gray. Antlers broadly palmate, solid portion nearly two feet at the widest point, several tines project forward and the outer edge of the flat portion is fringed by an irregular series of points.—(S. & C.)

Weight—Not many authentic weights of moose have been recorded. Live weights of 900 to 1,400 pounds represent probably full-sized bulls at their prime.

Range—Eastern British America, Maine, Minnesota, and Montana and formerly northern New York. Replaced in Alaska by the Alaskan moose (*Alces gigas* Miller), a still larger beast and the largest known member of the deer tribe.—(S. & C.)

The intrepid French voyageurs of the sixteenth century were the original explorers of northern North America and the first civilized men to see the Canadian moose. Quickly they named the new animals according to those they had known at home. Wapiti became "*cerf du Canada,*" the Virginia deer "*dain*"; but they could not

place the moose, and were forced to call him *un original* whence came the French names *l'original*, *l'orignat*, or *l'orignac*. The first English travelers, similarly at a loss for a name, adopted the Indian word *mong-soa* or *mongswa*, said to mean "twig eater."

Lescarbot, writing about 1609, gives probably the first printed mention: also the earliest drawing of moose is found in his map of Port Royal, Nova Scotia, of the same date.

The primitive range of the moose is curiously but little changed to-day. Only on Cape Breton and in northern New York can this wild animal be said to be completely exterminated. The range is actually greater to-day with good game laws than it was thirty years ago. It is now common report that moose are to be seen in regions where they were formerly unknown or very rare. Some writers claim that the moose migrate slowly from one large area to another through periods extending over many years. If this be true, it will naturally cause some revision of the figures on the numbers of moose existing.

The entire range is about 3,500,000 square miles, and in round figures the number of moose may be estimated at perhaps a million. At the moose's ordinary rate of increase how long should it take to double their numbers? Experience shows that under the most favorable conditions we could not reckon on an annual increase of more than one fifth of the herd. An annual drain of one quarter would lessen the number of moose; if the drain were one fifth they might hold their own; if one sixth they would presumably be increasing. There is a good deal of accumulated testimony from old Canadian hunters to the effect that the number of moose is increasing slowly but unmistakably.

The antlers' size and shape have even less relation to the age of the animal than with the wapiti. After the third year no one can tell the age of a moose from the antlers.

The young bull grows his first pair—two snags a few inches long—in his second summer, shedding them the following spring. Next year he grows his prongs. His third pair will have a beginning of palmation. The full development is attained about the seventh or eighth year; then comes a period of little change followed after three or four years by a decline. In a very old specimen the upper part of the antler will be merely scalloped along the edge and the web is of great breadth. Locked antlers so common among wapiti and caribou are also found among the moose.

The so-called "bell" on the throat is a marked peculiarity of the bull moose for which no satisfactory explanation has as yet been given. The bell is a long dewlap of skin with appropriate blood vessels. Sometimes it is round, sometimes flat, lying either lengthwise or crosswise on the animal's throat; sometimes single and sometimes forked; but never with discernible scent glands. It may be found on all moose with little regard to age or sex. Ordinarily eight or ten inches long, an extreme length of thirty-eight inches has been credibly reported. Such growths are occasionally found in other animals, but are always somewhat of a rarity.

The track of the moose through the woods is "like the track of a cow but sharper." The trained observer quickly learns to determine by the freshness of the track the amount of time that has elapsed since the moose passed. The size and height of the marks on trees and saplings in winter will usually differentiate the moose from

smaller deer. The dung balls resemble in character those of other large deer, but their size is distinctive. Other moose signs are the nipping of twigs at great height, the scraping of trees with antlers, and the deliberate crossing of bogs.

In the depth of winter the horns of the bull are quickly dropped. Yet he is not by any means disarmed, for his stout horned forefeet are ample protection against bear or wolf that might take the risk of assailing him.

The "yarding" of the moose is misunderstood by those who have not given the matter attention. As the snow commences to deepen, the more the moose must move around—within narrow limits—in search of food. The longer they stay winding in and out among the pathways they have made, the more snow they beat down; so eventually the moose yard is apt to present a hard, well-trodden surface. If food is sufficiently abundant and no hunters appear, they remain in the one yard till spring. If food gives out, they must search another feeding place. This journey is made in single file, the little ones in the rear, and it is only on such a journey that they fear the wolves. A moose yard is commonly frequented through the winter by the moose birds (*P. canadensis*), presumably because the moose by tearing down and rooting up logs and dead trees expose worms; or else the birds feed on parasite insects in the hair of their friends and protectors.

With the melting of the snows the family scatter. The bulls seek a quiet spot in which to nourish their budding antlers. The cows, usually accompanied at a respectful distance by their young of the year before, seek good grazing, and get themselves ready for the nourishment of the as yet unborn calf. This takes place in some remote thicket,

in late May. The calf (one or two, very rarely three) will be dull reddish brown with none of the lighter spots that characterize other members of the deer family. The mother never goes far afield while the calves are in hiding. As soon as strong enough they begin to follow her about and remain with her throughout the summer.

Meanwhile, the bull moose is nourishing his antlers, which will hardly be full grown before September. During the summer the big animals are semi-aquatic, spending much of the time where they may avoid the heat and flies and reveling in the lily pads which are considered a special delicacy. Usually, however, the bulls keep by themselves, often in pairs of twos.

By September the antlers are sunburnt to a deep brown, except the tips, which are white and polished from rubbing them continually on brush and trees. Early in September the rut sets in.

The bull now fares forth on his travels. Every few miles a hardwood ridge between swamps or a stretch of open woods becomes a sort of meeting place of the sexes. To these in turn Mr. Moose goes, nosing the earth and wind for helpful suggestions. Hearing a sound from a fellow male, he challenges with a deep, long grunt or a sharp bellow, approaches rapidly, slashing the brush to impress his rival, circling about to try the wind from the stranger or (if there be no wind) repeating his various callings and beatings of the brushwood. It is rare to find a moose horn without the dent of battle. In these combats the weaker generally saves himself by flight: it only occasionally happens that one of the warriors is killed; and occasionally, again, the battle is doubly fatal through the locking of the antlers.

With a birch-bark trumpet it is possible for a skillful moose caller to imitate the bellow of the cow moose and tempt the bull forth for observation or an easy shot. This tempting but not very sportsmanlike method can only be practised for a fortnight or so at the beginning of the mating season and in certain kinds of weather. A dead calm is essential. The moose caller begins very low, as there is always a possibility of a bull lurking in some near thicket. A call should not be made more than once in ten minutes. The bull's answer is a deep, long grunt varied by the snapping of branches as he plunges forward through the woods. A moose may get the call five or six miles away, and might be an hour in getting to you.

There are many chances of disappointment between a response and a fair view. A puff of wind may waft the human taint to Mr. Moose, he may detect a false note in the voice of the siren, or he may turn aside for another and more attractive note, that of a real cow.

Oh–ah—oh-ah is thought to get as near as is possible to the bull call. The cow call varies, usually consisting of three notes, the second one greatly prolonged and possessing the greatest volume of sound. *Moo—waugh—yuh* is thought by Edward E. Flint, from whose interesting account in *Forest and Stream* we are quoting, to represent as closely as is possible the cow call.

The moose has long been pointed out as the only deer that is strictly monogamous. There is no record of a bull seen with a herd of cows in the mating season. A moose that is mated will not reply to a calling cow, call she ever so tenderly. On the other hand, many hunters maintain that the bull roves from one cow range to another and, though he is rarely seen with more than one cow at a

time, will mate with many in one season. Whether the bond lasts more than one season is another question on which it is difficult to get much evidence.

The young bull is tolerated by his step-father while still a calf, but about the second year when he becomes a "spike-buck" (that is, with antlers forked into a couple of spikes) he is likely to acquire a wandering disposition. Probably he will drift back to the family group for the period of winter, but another fall—his third—will see him fully equipped with flat horns and a lusty body. Quite likely he will try a few passages at arms with some of the reigning monarchs, but usually he ends by flight into regions far away. In the autumn young bulls are to be found roaming solitary over the country in the most unlikely places.

The moose condenses his amorous pleasures into a couple of weeks, at the conclusion of which he has no longer any objection to receiving his step-children back into the family. With the approach of winter the family group in the moose yard is likely to be complete.

The well-known wallow of the bull moose has never received adequate explanation. At a chosen point in the thicket he digs and paws the mud and irrigates it abundantly till it becomes a mud bath that has the appearance and odor of a cesspool. What the bull accomplishes by this is uncertain, but it has certainly some connection with the perpetuation of the species.

The moose is marvelously endowed with smell, hearing, wariness, and speed, but it is a common observation that a moose seeing a man without smelling him is likely to stand and gaze in blank curiosity. This happens oftenest during the summer while the animal is in the water and

the man in a canoe. Nearly all the good photographs of wild moose have been taken at such times.

Ordinarily, the moose are the wariest of wild things. They generally lie with their tails to windward and they have the extraordinary instinct to make a short turn and sleep below the wind of their fresh track. Any one following up the trail is thus sure to be heard or smelt before he gets within shooting distance.

The enemies of this noble animal are wolves, bears, cougars, deep snow, mosquitoes, and ticks, and perhaps most of all the hunter with his gun. In deep snow the moose is in evil plight, and it is only at such times that strong males have reason to fear the wolf.

The old bull is apt to be bad tempered all the year and really dangerous in the autumn. The moose in captivity has on the whole a better reputation than other members of the deer family. Moose have been broken to harness and found tractable and very advantageous for light, swift travel. Tame moose have been known to gambol with children, dogs, or young cattle, to come when called, to acquire kittenish tricks such as playing with round balls and pebbles. No grown moose is entirely safe in the autumn, however, and had best be handled with care.

In the great northwestern belt of swamp and timber land the moose is the mainstay of the native Indians. The flesh furnishes food and its hide clothing and moccasin leather and snowshoes. Its back sinew is sewing thread; horn and bones make tools; the coarse, bristly mane furnishes raw material for embroidery. Indeed, through the winter months particularly the Indian would find it difficult to sustain life without the assistance he receives in one form or another from his antlered foe.

V. Woodland Caribou (American Reindeer)

Rangifer Caribou (Gmelin)

Length—6 feet. *Height at shoulder:* 4 feet. *Length of antler:* 30–40 inches.—(S. & C.)

Description—Differs from other members of the deer family in the presence of antlers on the female as well as the male. The muzzle is also entirely covered with hair; the feet are more deeply cleft. Dark dove-brown, lighter in the neck, posterior part of the abdomen, and inside of legs as well as a band just above the hoofs white; muzzle and face dark except the front of the upper lip. Grayer in winter with head and neck nearly white. Antlers with one (rarely both) of the brow tines flattened and palmate, standing out vertically in front of the face. Above this is another branched tine more or less palmate and the summit of the antler is again palmately expanded. Exact pattern and extent of the palmation exceedingly variable.—(S. & C.)

Weight—The woodland caribou is larger than the white-tail, smaller than the wapiti. A large caribou from Maine in the New York Zoölogical Park weighs 280 pounds.

Range—Wooded parts of British America, northern Maine, and Montana.—(S. & C.)

There are seven kinds of caribou in North America which appear to be quite distinct and geographically separated from one another, and all of them certainly different from the reindeer of Europe. They fall into two groups: the larger woodland caribou and the smaller Barren Ground Caribou.—(S. & C.)

Although the caribou was a common and characteristic inhabitant of the northern parts of the continent visited by Cabot and by Cartier, this species seems not to have been discovered by white men till after the wapiti, the white-tail, and the moose. "Caribou" or "Maccaribo" appears clearly from ancient records to have been a native American word.

The caribou is the reindeer of America. The hunter who follows the caribou must be the best of travelers. The moose may trot through the brush at the rate of fifteen miles an hour, but the moose will be satisfied when it has merely moved across its narrow range. The white-tail is sure to stop and settle down a while after circling a mile or two. The caribou keeps sometimes walking with long mile-eating strides, sometimes trotting, turning aside for nothing, its lower speed offset by its persistence and directness, very often spending the night one hundred miles from the place where it started in the morning.

There is no species of deer in America in which the females have not occasionally been found with antlers. Among caribou it is the rule to wear them. According to the usual accounts the bull's horns are shed in mid-winter in January, or perhaps as early as December if the animal be of exceptional vigor. The young bulls carry theirs till early spring. The cows keep theirs till summer is near, dropping them out the time the calf is born. The finest horns are seen in the great black caribou of Alaska (*osborni*). These, more than other varieties, combine large size and many points with remarkable symmetry and with six perfect shovels fully and evenly developed. Of the American reindeer, the woodland

caribou is believed to have the smallest antlers, the Newfoundland the most massive, and the Barren Ground the slenderest.

All winter the woodland caribou are to be found in small bands of both sexes, comprising as few as five or often as many as twenty-five or thirty members. Gregarious animals have usually many means of communication with their fellows. With the caribou the sudden elevation of the white tail, when danger is sensed, is a silent alarm immediately understood by the nearest of their kind.

The most singular of the sounds made by the American reindeer is the clicking or creaking of the hoof which can be heard at a distance of a hundred feet in still weather. When a herd is moving forward the crackles from their hoofs make a volume of low, continuous sound. Close examination shows that this crackle is made by some mechanism in the hoof and that the crackle occurs, curiously enough, while the weight is on it. The object of this unusual sound is, doubtless, to let others know that the individual is moving forward, or to let the fawn know that its mother is on the march and that it must keep alongside.

The hoof of the caribou is one of the most wonderful of nature's adaptations to special necessities of environment. In the season of deep snows the frog is entirely absorbed and the edges of the hoof, now quite concave, grow out in thin, sharp ridges. The shell grows with great rapidity and the frog does not fill up again till spring when the antlers bud out. With this great lateral spread and with the additional assistance of the long stiff bristles which grow downward from the fetlock, the caribou advances

vigorously over crusted snow and frozen lakes. When the moose would soon flounder shoulder deep and the graceful deer would fall in despair the caribou glides on, indifferent and supreme.

And again the hoofs make fine paddles. The caribou takes to water without hesitation, and the best of canoemen will have difficulty in gaining much distance on a vigorous buck.

The American reindeer appear admirably adapted to the conditions under which they live, and there seems no apparent reason why numbers should not be far greater than any known figures that have ever been reported. Perhaps it is because of the countless foes of the insect world. All summer the caribou are harassed by clouds of mosquitoes which drive them to the open where they are seized upon in turn by several varieties of gadfly. The caribou are the only deer that at certain seasons gather in herds to travel clear out of one region to another quite distant and entirely different.

In the early spring the large bands drift in a northerly direction and, as the snow gets soft, break up, the old males going off by themselves. The calf is born in June, with coat of reddish brown varied white, but not spotted all over. Confirmation is lacking, but it is thought that as with the Norwegian reindeer, the caribou does not hide the calf, which is strong enough to follow the mother within an hour of birth.

Early in October the rut sets in, the bulls contending with each other as do the wapiti. Probably, as with the Norwegian species, the bull beats off others from as many cows as he can secure and devotes himself to them for the season. By November, when the bands gather for the

southward journey, the bulls have become quite indifferent to the presence of others of the same sex.

In character the caribou is a strange mixture of wariness and stupidity. The hunter can never be sure what the animal is going to do next, but may be sure that he is going to do it with amazing energy and persistence. The caribou's eyes and ears are good, but it relies chiefly on its sense of smell, which is extraordinary.

II

PRONG-HORNS

Family *Antilocapridae*

This family contains only the curious prong-horn or antelope of our Western plains, an animal intermediate in many ways between the deer and the cattle.—(S. & C.)

American Prong-Horn

Antilocapra americana (Ord)

(Also called *Antelope, Cabrit,* or *Cabrie*)

Length—4 feet 6 inches. *Height at shoulder:* 2 feet 10 inches.—(S. & C.)

Description—Horns hollow, like those of the cattle but regularly deciduous like the antlers of the deer, and forked. The two small rudimentary hoofs usually seen in ruminant animals behind and above the large pair are entirely absent. Muzzle covered with hair except a narrow line down the middle, eyes very large and a short mane on the back of the neck. Above light yellowish brown; throat, neck, and under parts white; forehead, nose, and spot below the ear dark brown; sides of the head, spot behind the ear, and triangular patch on the shoulder joining the throat white. —(S. & C.)

Weight—A fair-sized buck will weigh about 100 pounds. The females are smaller and lighter.

Range—Saskatchewan to Mexico; Missouri River to th

Rocky Mountains and the Cascade Mountains of Oregon and Washington.—(S. & C.)

Though he does not mention them specifically by name, Francisco Vasquez de Coronado, Spanish explorer and adventurer, undoubtedly saw the antelope on his famous trip northward from Mexico to probably what is now Kansas in 1540. Herrera (1601) mentions the antelope under the name of *berrendos*, by which they are yet known in Mexico. The word cabrit, or cabrie, used by the half-breeds of the Northwest, is thought to be a Basque corruption of the Spanish *cabra*, a goat.

Though in California and Texas it was originally found down nearly to sea level, the antelope is by choice a creature of high and open plains. Its preference is the flat country, but it will be found at times on any sort of territory where its feet may rest on hard, dry ground. The antelope is a creature of small home locality and, when climate and food supply permit, as is the case in the southern part of its range, a permanent resident. In colder regions it is forced to journey, sometimes northward as well as southward, but always seasonally, in search of more nourishing food supply.

The number of antelope existing to-day or even in early times is excessively hard to estimate. Their present range covers about a million square miles, roughly one half of what it was at the time of the arrival of the first white man. If ten antelopes be estimated to a mile there would be a former population of ten million antelopes. The population in 1900 is to be estimated at certainly no more than a hundred thousand, probably much less.

It is well known that true horn is theoretically a mass of

consolidated hairs. The process of hair growth, of consolidation into horn, and the actual shedding, are all demonstrated in the horn of the antelope. Investigations show that the male antelope has at birth a small bump over each eye. At the age of four months a small horn breaks through the skin. When about an inch long this is dropped, or pushed off by a new horn growing below it, on the top of the bony core, which also grows rapidly. The next year the shedding takes place earlier but the bony core remains. Above this core the prong is developed. Old bucks shed in October immediately after the rut. The male antelope has the advantage over the mule deer in that his new horn is already well sprouted before his old horn is dropped. The story is told of a hunter firing on a buck antelope with unusually large fine horns. On approaching the body of the dead animal he could hardly believe his eyes when he saw that the buck had for horns nothing but two miserable little spikes. The puzzle was explained when, in looking about, he found near where the buck had first fallen a pair of large horns recently shed.

The white area on each buttock serves the antelope in unusual fashion both as an identification mark and as a warning of impending danger. Under the skin covering this white area is a circular muscle by means of which the hair on an instant's notice can be raised and spread radially. Like a tin pan in the sun, this quick jerking motion gives flashes of light that can be seen farther than the animal itself. And in case sight should fail, a musk gland concealed in the centre of the patch produces scent that can be distinguished by man with his poor nose twenty or thirty yards down the wind and by the antelope at great distance, perhaps a full mile.

Many animals are furnished with glands that produce odors utilized for defence or for intercommunication. The antelope is unusually well provided, having glands in the jaws, in the hoof, and on the rump. As to the use of the glands on the jaw we can no more than hazard a guess that they are in some way related to the sexual system. The hoof scent probably serves notice, strong or faint, that animals of the same species have passed that way.

The sound oftenest heard from the antelope is a querulous half bleat, half grunt, uttered by the mother when she is calling to the kid. The youngsters utter a fainter bleat or squeak in reply. As might be anticipated in a wild animal living in the open, the eye of the antelope is large and beautiful, "larger," Judge Caton says, "than the eye of any other quadruped of its size."

Lewis and Clark, on their memorable journey of 1803–06, commenting on the antelope, were struck with its speed, first among the four-foots of America, and also with its inordinate curiosity. "The antelope has three very distinct gaits. When fleeing from danger it carries its head low like a running sheep and gallops by long leaps; when showing off, it holds its head as high as possible and trots. . . . Occasionally it gallops with high head by stiff-legged leaps like the mule deer." (Hornaday.)

After the horse, the antelope is the fleetest animal on the continent. Greyhounds have doubtless caught antelope in open chase, but one greyhound cannot catch a full-grown, unwounded buck antelope by fair running. Actual figures are impossible to obtain, but railway men in the Far West have often had chances to test the running powers of the antelope. At twenty-five or thirty miles an hour an engine could not pass these fleetest of animals,

but if the speed were increased to thirty-five miles an hour, the antelope would quickly give up the contest in disgust.

The comparative speed of wild animals, as closely as it can be determined, should run something like this. Best speed per hour for one mile:

Race horse	34 miles
Prong-horned antelope	32 "
Greyhound	30 "
Texan jack rabbit	28 "
Common fox	26 "
Northern coyote	24 "
Foxhound	22 "
American gray wolf	20 "

In general, the wild animals are less swift than is commonly supposed. Their strong point is the quickness with which they can reach top speed. The few seconds that an animal can save at the start is what in most cases enables him to escape. Many predacious animals, cats, for instance, will give up the chase after failing on the first dash.

The uncontrolled curiosity of the antelope in early days was notorious. A handkerchief waved on a stick by a concealed hunter was sufficient to draw an animal within gunshot at the time the first white men arrived. Presently the wildings gained wisdom, and could no longer be enticed by simple tricks of this nature.

The food of this species has been long confined to grass, cactus, sage, products of the dry plains. In captivity they can be with difficulty induced to touch twigs, browse, or leaves. The antelope will go a considerable distance in

search of water, yet in many dry plains far removed from rivers or lakes he seems to survive for long intervals, sustained probably by the moisture that is found in the fleshy leaves of the cactus and other plants of like nature.

Antelope rarely live long in confinement, being subject to fatal enteritis, presumably in consequence of improper food. The fawns are tameable if caught young, but quite delicate and difficult to bring to maturity.

The worst enemies of the wild antelope are, as for others, first the repeating rifle. Next, perhaps, sheep which destroy their winter range. Coyotes, wolves, and eagles make away with many, especially fawns. Coyotes, when hard pressed by hunger, have been known to organize a hunt on a system of relays, thereby eventually running down even the swiftest of antelopes.

The home life of the antelope does not differ markedly from that of other wild animals of a generally similar character. During the winter they live in mixed bands of all ages. Early in spring the sexes scatter. The fawns are commonly two in number, born in late May or early June. The mother hides them together for several days. Within a fortnight they are thought to be able to follow her about. It is during this interval that they are sometimes discovered and attacked by wolves and coyotes. The mother displays most devoted courage in their defence, butting and striking with her short horns, dealing quick, severe blows with her forefeet. She will certainly be an overmatch for a single coyote, and it is undoubtedly true that most of the successful raids are accomplished when she is too far away to render assistance.

As soon as the young can follow, the tendency is to form small bands of mothers and kids. Early in August the

younger bucks have begun to join the bands; the kids are getting half grown and acquiring a livery. In September the antelope bands offer at times a pretty picture in their community gambols that are probably unique in the animal world. Particularly does the buck display sportive tendencies at this time, and has been seen repeatedly gamboling with the youngsters, leading them to and fro slowly or at full speed, capering and prancing about them, displaying an interest quite in contrast to his indifference or hostility of other seasons.

But as October approaches the bucks grow more restless. Presently the rutting season is under way, and the big bucks begin to gather the does into harems. Each buck is now constantly on the watch both to keep his harem intact and to make additions to it when opportunity offers. Buck duels are the order of the day and are fought with vigorous thrusts and counter thrusts of the sharp horns.

Two bucks approach, noses to the ground, and after fencing for an opening, close with a clash. They thrust and counter thrust, the prong serving, as the guard on a bowie-knife serves a man, to catch thrusts that would have slipped up the horn and reached the head. The in-turned, harmless-looking points, if by skillful maneuvering they may be brought to bear on the unprotected throat of a rival, are capable of inflicting fatal injury. But few of the buck duels end this way; more frequently the lesser buck merely takes refuge in flight.

"Observe now a flock of these beautiful animals; they are not afraid of man—they pause in their rapid course to gaze on the hunter and stand with heads erect, their ears as well as eyes directed toward him, and make a loud noise by stamping with their forefeet on the hard earth;

but suddenly they become aware that he is no friend of theirs and away they bound like a flock of frightened sheep—but far more swiftly, even the kids running with extraordinary speed by the side of their parents—and now they turn around a steep hill and disappear, then perhaps come in view and once more stand and gaze at the intruder." (Audubon.)—(S. & C.)

III

THE CATTLE

Family *Bovidae*

To this family belong all the domestic cattle and their allies the bisons and buffaloes, wild sheep and goats, as well as the great host of antelopes found in Africa and Asia. Our American representatives are few in number, comprising only the mountain goat, mountain sheep, musk ox, and buffalo.—(S. & C.)

I. Mountain Sheep

Ovis cervina (Desmarest)

(Also called *Bighorn*)
(S. & C.)

Length—4 feet 6 inches. *Height at shoulder:* 3 feet 4 inches. *Length of horn round curve:* 50 inches. *Circumference at base:* 14 inches.

Description—Body heavy, legs rather slender, hair everywhere closely appressed, no mane or beard. Horns in female short, in male massive, curving backward and outward and in old rams making a complete spiral circle. Grayish brown, darkish on the back; under parts, inner side of legs, upper throat, and patch on rump and round the base of the tail whitish; lighter and grayer in winter.

Range—Higher mountains from British Columbia to Arizona.

Bighorns from various sections of the country present somewhat different appearance in color and in size and shape of horns. Seven different varieties are now recognized.

The mountain sheep scale the rugged cliffs and leap over precipices with the same confidence that marks the chamois of the Alps. "Their ideal haunts are the slopes of high mountains above timber line, near the edge of the snow fields that are perpetual," writes Doctor Hornaday. "It is essential that one side of the mountain sheep's home ranch should fall away abruptly in ragged lines of perpendicular rim-rock with caves of slide-rock below, in order that the sheep may have the means of escape from their numerous enemies, particularly hunters."

On finding themselves in view of hunters, two rams, mentioned by Doctor Hornaday, dropped over the edge of a plateau, and ploughed down a narrow cleft filled with slide-rock. The trail then led along to the foot of a 200-foot wall of rim-rock and close along the base till it dropped over to the next lower wall. "It became evident that only by hours of patient work could these animals be encountered again, if at all."

The mountain sheep are polygamous, an old ram driving off the young males and watching over the ewes and lambs. The inaccessibility of its favorite ranges as well as the wariness and extraordinary agility of the animal have kept the bighorn from being entirely exterminated. The meat is excellent and the horns highly prized. "The head of

the male bighorn is a trophy which appeals to all sorts and conditions of hunters except Indians," says Doctor Hornaday. "In the grandest head the noble red man sees nothing more than a pair of horn spoons for his soup kettle. Thousands of *Ovis cervina* have been hunted down and killed for their heads alone and thousands more have met their death before the rifles of sportsmen because they are grand game."

The unbranched horns curve backward from above the eyes. The ear is near the center of the incomplete circle formed by the forward-pointing tip of each horn which is angular, ridged, and very massive at the base. Fourteen inches around the base of the horn is a big specimen; such a horn will measure forty or fifty inches along the outer curve.—(S. & C.)

The bighorn manages to keep fat and contented on slopes above the tree line that are covered a large part of the year with snow. Favored hollows and slopes will often be found to be thickly strewn with luxuriant grass in summer. In winter they still find moss and vegetation of a sort by pawing through the snow.—(S. & C.)

Audubon made the acquaintance of the mountain sheep in 1843 and was struck by their statuesque attitudes. He says: "In many places columns or piles of clay or hardened earth are to be seen eight or ten feet above the adjacent surface, covered or coped with a slaty, flat rock, thus resembling gigantic toadstools; and upon these singular places the bighorns are frequently seen, gazing at the hunter who is winding about far below, looking like so many statues on their elevated pedestals. One cannot imagine how these animals reach these curious places, especially on these inaccessible points, beyond the

reach of their greatest enemies, the wolves, which prey upon them whenever they stray into the plains below." —(S. & C.)

II. American Bison or Buffalo

Bison bison (Linnaeus)

Length—11 feet (adult bull). *Height at shoulder:* 5 feet 8 inches.—(S. & C.)

Description—Hind quarters light and short haired; fore quarters very heavy, with a high hump on the shoulders, and densely haired; head held well down below the level of the shoulders; horns curved outward, upward; tail with a terminal tassel. Body and hind quarters pale gray brown; lower parts dark brown; shoulders, hump, and upper neck covered with a dense mass of yellowish hair; head, lower part of neck, and forelegs to the knees with dense shaggy hair, dark brown above and black lower down.—(S. & C.)

Weight—About 1,800 pounds is considered average weight for a bull and for a fat cow about 1,200 pounds.

Range—Originally. Great Slave Lake to northern Mexico, New Mexico, and Nevada; eastward south of the Great Lakes to central Pennsylvania, Virginia, Georgia, and Mississippi.—(S. & C.)

In 1870. Great Slave Lake to Wyoming and central Texas, eastward to central South Dakota, Kansas, and Indian Territory.—(S. & C.)

In 1880. About 250 in the extreme Northwest; about 300 in Montana, Dakota, Wyoming, Colorado, and Indian Territory.—(S. & C.)

In 1890. Restricted to Yellowstone Park and other preserves.—(S. & C.)

The bison, or buffalo, the largest and at one time the most important of American big game, was probably first seen by Cortez, the Spanish conqueror of Mexico, in the menagerie of Montezuma's capital, the City of Mexico. Another Spanish adventurer, Alva Nuñez Cabeza de Vaca, is credited with having been the first of white men to gaze on the animal in the wild. The earliest known picture, somewhat distorted and grotesque, is to be found in Gomara's "Historia de las Indias," a folio volume published at Saragossa in 1552–53. In the Eastern country the first sight of a buffalo is apparently to be credited to an Englishman, Sir Samuel Argoll, who somewhat later, in 1612, first saw and also partook of the flesh of the buffalo near the head of the "Pembrook (Potomac) River."

From these times onward the region of the buffalo was often visited, and explorers have given frequent descriptions of the great beast and its vast numbers. Whereas the buffalo were scattered sparsely over the whole Western country, the true home of the species, where they were found in almost incredible numbers, was the open region of the great Mississippi Valley. Here the land was unforested but yet well watered. In wooded portions of the country they existed but were at all times comparatively rare.

The number of buffalo in primitive times is estimated to have been certainly no fewer than fifty million head and possibly as many as seventy-five million; but by 1800 they had already disappeared east of the Mississippi; and the number west may have been perhaps forty million. In 1889, less than a hundred years later, the number of known buffalo, all in captivity, was 256. Even considering the great numbers slaughtered by whites and Indians,

even considering natural causes, blizzards, and prairie fires, the gradual narrowing of ranges, it still seems extraordinary that an animal which had existed and flourished in such vast numbers could have been exterminated utterly in the wild in such a short space of time.

To understand what a buffalo herd was in its prime, read the statement of Col. R. I. Dodge, who in 1871 passed through one of the immense herds while traveling in Arkansas.—(S. & C.)

"The whole country appeared one great mass of buffalo moving slowly to the northward; and it was only when actually among them that it could be ascertained that the apparently solid mass was an agglomeration of innumerable small herds of from fifty to two hundred animals, separated from the surrounding herds by greater or less space but still separated. The herds in the valley sullenly got out of my way, and turning, stared stupidly at me, sometimes at only a few yards' distance. When I had reached a point where the hills were no longer more than a mile from the road, the buffalo on the hills, seeing an unusual object in their rear, turned, stared an instant, then started at full speed directly toward me, stampeding and bringing with them the numberless hordes through which they passed, and pouring down on me all the herds, no longer separated, but one immense compact mass of plunging animals, mad with fright and as irresistible as an avalanche. Reining in my horse, I waited until the front of the mass was within fifty yards, when a few well-directed shots split the herd and sent it pouring off in two streams to the right and left. When all had passed they stopped, apparently satisfied, many within less than one hundred yards. . . . From the top of Pawnee

Rock I could see from six to ten miles in almost every direction. This whole vast space was covered with buffalo looking at a distance like a compact mass."—(S. & C.)

Though the buffalo covered a vast region, they continued in large measure as one species. Theoretically, therefore, they should be classed as migratory animals. In practice their movement northward in spring and southward in autumn was usually so much observed by temporary changes of direction to meet changes of weather, to visit well-known pastures, to save crossings of rivers and mountains, as to have the appearance of being quite aimless.

Certain natural causes at all times must have kept the number of buffalo from increasing to such numbers as to threaten the extinction of the food supply. Blizzards and prairie fires made huge slaughter. Early settlers speak of buffalo hordes trapped in impenetrable snow-drifts in narrow valleys or seriously burned or maimed in prairie fires. The obstinate adherence to one course that characterized the animal at all times led thousands to the death in bogs and in icy rivers. For generations early settlers on the Missouri saw dead buffalo borne downstream in the yearly floods and early diaries tell of the intolerable stench arising from vast numbers left stranded on river banks. Clearly, the rifle did not account for all the buffalo that perished between 1800 and 1890.

Before proceeding with his life history, let us pause to consider the animal a little closer. It is customary to speak of the enormous head of the bull as a thing out of proportion to his bulk; but divested of its wool, the head will be found to be of the same proportion as that of the horse and other domestic animals. The largest recorded horns

are twenty-one or twenty-two inches long with a girth of fifteen or sixteen inches, and the widest spread of about thirty-five inches from tip to tip.

There were many freaks and color varieties of the well-known buffalo "robe." Of the "beaver robe," a rich brown and very fine fur, there was perhaps one in ten thousand. The white "robe," of which no more than one or two were found in the hunting of a lifetime, was treasured by the Indians as "great medicine." The great Cheyenne chief, Roman-nose, wore a robe of pure white buffalo hide as he charged fearlessly at the head of the Indians who fell in the leaden hail of Forsyth's troops in 1868.

As summer advances the buffalo shed their coats in great broad flakes or wads of mothy-looking felt, till the hinder portion of their bodies becomes positively bare. As an offset against the vicious attacks of mosquitoes the huge animals, particularly the males, wallow in mud holes till they acquire a thickly baked coat of mud which will perhaps last a couple of weeks.

George Catlin, in his well-known work on the North American Indians, has described the process: "In the heat of summer these huge animals . . . often graze on the low grounds in the prairies, where there is a little stagnant water lying amongst the grass, and the ground underneath being saturated with it, is soft, into which the enormous bull, lowered down upon one knee, will plunge his horns and at last his head, driving up the earth, and soon making an excavation in the ground into which the water filters from amongst the grass, forming for him in a few minutes a cool and comfortable bath into which he plunges like a hog in his mire. . . . He throws him-

self flat upon his side, and forcing himself violently around, with his horns and his huge hump on his shoulders presented to the sides, he ploughs up the ground by his rotary motion, sinking himself deeper and deeper in the ground, continually enlarging his pool, in which he at length becomes completely immersed, and the water and mud about him mixed into a complete mortar, which changes his color, and drips in streams from every part of him as he rises upon his feet, a hideous monster of mud and ugliness, too frightful and too eccentric to be described."

In default of such opportunities the buffaloes rub themselves against trees and boulders. On the plains of the Souris in southern Manitoba the boulders are smooth with a hollow worn about them from the scrubbing given by the buffaloes. All the first telegraph poles across the plains are torn down in the zeal of the buffalo for suitable scratching posts. When the poles were protected by spikes, the sharp points, rather than being a hindrance, seemed to give additional pleasure to the big thick-skinned brutes.

Let us follow the migration of a buffalo herd from the bottom lands along the Missouri in central Dakota to their summer feeding grounds along the level prairies of the Red River Valley.

Some warm spring day the spirit of unrest comes to a head, fifty or a hundred, led by some grandmother, or more likely great, great-grandmother, starts the procession northward. Presently from every valley a long black string pours forth. As they top the uplands, others and yet others come into view. As night comes down the herds shelter in the hollows of the hill. Cold weather or snow will not turn them back. They cross on ice or swim open rivers; if rotten ice breaks through, many are

drowned; those behind press on indifferently. For three or four weeks this continues till the summer grazing grounds are reached. Now the bands that united to form the close-packed herd that roused the wonder of the intruder man quickly disintegrate, small groups led by old cows drift away not to come together again till the time of the great trek southward.

These small groups are generally thought to represent a clan with blood ties throughout the groups. The female calf often stays with her mother's family for life, the young male for two years only, when he is driven out. The buffalo are polygamous, so that those living together are sure to be much interrelated.

Sometime in April, it is thought, though births are known to have occurred as early as January and as late as August, the cow has finished her period of gestation. Labor is short and easy; within an hour the mother is able and ready to meet the gray wolves that hang about the packs watching for just such opportunities. Help also is generally near at hand. Her loud shout or threatening bellow will quickly bring the bulls to her aid. Much testimony is available of efficient aid given the cows and helpless calves by the male members of the herd during such emergencies.

From his exemplary attitude toward the young some observers have considered the buffalo to be monogamous. Others maintain that there is no mating, the species being promiscuous; still others that extreme polygamy is the custom, the strongest bull driving the weaker forth and holding the herd as his harem.

The furious battles of rival bulls have been frequently observed. In the running season in July (later in the

north) the whole herd becomes an agitated, bellowing mass, pawing the dirt and engaging in desperate combats. As the mating season draws to a close the clan divides, the males in one herd, the females in another. Rich autumn pasturage soon gets the animals back into good shape, and when the great trek starts southward, the band is again united, the great, great-grandmother leading the way as before.

The buffalo seems to be longer lived than the ordinary bovine. Bulls continue to breed till more than a dozen years of age and individuals are known to have lived more than thirty years. About the fringes of every herd roam old bulls rarely molested by either man or wolves. Too tough for man to eat and avoided by wolves unless hard pressed by hunger, they linger on indefinitely until perhaps from sheer senile atrophy they fall in their tracks.

Efforts made from time to time to domesticate the buffalo have never had marked success. Experiments made by Col. C. J. Jones (Buffalo Jones) of Kansas produced a hybrid from the buffalo and the common cattle to which the name "cattalo" was given. The cattalo is hardy, able to paw and root through the snow for grass which ordinary cattle would never reach, and produces a robe much superior to the average buffalo robe. But the hybrid has never advanced beyond the experimental stage.

The buffalo leaves behind him a lasting monument. These pioneers organized the strategic paths across the country from which came in quick succession the game trail and the pack trail, the dirt road and the railroad. The buffalo planned the route through the Alleghanies by which the white man entered and possessed the Missis-

sippi Valley. But even before the white men, the Sioux Indians, which have been proved to be an Eastern coast race, followed the buffalo through the Alleghanies and the Mississippi farther and farther west.

Buffaloes were normally very stupid, and scarcely even in the last years of their existence realized the dangers of contact with the white man. "The buffalo was an animal of a rather low order of intelligence," says Hornaday, "and his dullness of intellect was one of the important factors in his phenomenally swift extermination. He was provokingly slow in comprehending the existence and nature of the dangers that threatened his life, and like the stupid brute that he was, would very often stand quietly and see two or three score or even a hundred of his relatives and companions shot down before his eyes with no feeling other than one of stupid wonder and curiosity. His stolid indifference to everything he did not understand cost him his existence."—(S. & C.)

In appearance the bull buffalo was easily the finest of our quadrupeds. "The magnificent dark-brown frontlet and beard . . . the shaggy coat of hair upon the neck, hump, and shoulders, terminating at the knees in a thick mass of luxuriant black locks, to say nothing of the dense coat of finer fur on the body and hind quarters, give to our species (the buffalo) a grandeur and nobility of presence which are beyond all comparison among ruminants." (Hornaday.)—(S. & C.)

III. Mountain Goat

Oreamnos montanus (Ord)

(Called also *White Goat*)

(S. & C.)

Length—4 feet. *Height at shoulder:* 3 feet.

Description—Body covered with long hanging white hair and a short woolly under-fur, entirely yellowish white. Shoulders rather humped and head carried below their level, nose hairy, a short beard on the chin. Horns slender in both sexes and curving slightly backward, black, as are also the hoofs.

Range—Higher Rocky and Cascade Mountains to Alaska.

The higher, almost inaccessible slopes of the British Columbian Mountains are the stronghold of the mountain goats. There, usually above the timber-line amid the wildest scenery, and surrounded by glaciers and precipices, they live practically unmolested except by the insatiable hunters. Living in such isolation they are in little need of speed or agility and are said to be rather slow and stupid beasts, easily secured if the surroundings admit of an approach.

The mountain goat presents many points of interest. In the first place it is not a goat but rather an outlying member of the great antelope tribe—to which by the way our American "antelope" does not belong. The nearest relatives of the goat are the serow of the Himalayas and the chamois of the Alps, though the long fleecy coat and goat-like beard give it a very different aspect.

In color too it is peculiar, being the only pure white ruminant animal known; this is an excellent protection, rendering it practically invisible during the snows of winter, though at other seasons it would seem to render it equally conspicuous.

In describing his experience in pursuit of this animal Frederic Irland writes: "The most charming innocent creatures that I met in the Cascade Mountains were the white goats. What do you think of a wild animal which, after he knows you are on his track, will stop and turn back, to peer around the corner and see what you are? These stately animals, with their long white aprons, coal-black eyes, and sharp little horns, really seem to me too unsophisticated to shoot. At Ashcroft and Lillooet people had told me to get my hand in by shooting a goat and then perhaps I could improve by getting a sheep. As usual we were seeking what we might destroy, though as a fact we let many chances go. We had nearly burst our hearts by climbing for an hour or two up the mansard roof of North America and high above the deer pasture. The winter on the mountain tops had driven the game down and sent the bears to their winter dens. We had found sheep tracks and were following along to see where they led, when suddenly we saw four white animals on the edge of an abyss of the kind which Doré has portrayed in illustrating Dante. The goats were not very far from us in a straight line, but it was a long way around. They saw us and started on a rheumatic gallop, but went only a little way, and as they reached a turn, huddled up and looked back. We picked our way over toward their last place of abode, reaching the opposite side of the canyon by means wholly unsuited to nervous

people. There was just snow enough to show their tracks which led along scandalous precipices. The fever of pursuit was on my guide, and he walked uprightly in places where I became a quadruped. This was trying to his patience, for he caught glimpses of the goats which I, by reason of slower progress, was denied. In about half an hour we came to a great chimney of rock in the path, and clinging with fingers and moccasins, he went around the face of it. . . . When I came out above him I saw he had the goats in a sort of natural trap, and they were all bunched up against a rock which I thought could not be passed. The biggest billy stood faced about, his long white beard and petticoats making him look like the high priest of some heathen temple. 'Don't shoot; he fall down,' yelled my guide. At the sound of the voice the goat made a desperate attempt at the face of the rock, scrambling up at an obtuse angle, then standing on his hind legs and throwing his fore feet over, from right to left. I thought he surely would fall back but he did not. The smaller goats followed and in a moment they were gone. . . . We made a flank movement and perhaps a quarter of a mile from the first round-up we saw those four fool goats again, the big one and a small one looking back around the corner to see if we were really coming. Then we did shoot and curiosity broke up that family."

Mr. Owen Wister, in one of the Boone and Crockett volumes, gives an interesting account of "The White Goat and his Country." Describing his first sight of the animal, he says: "We went cautiously along the narrow top of crumbling slate, where the pines were scarce and stunted, and had twisted themselves into corkscrews so

they might grip the ground against the tearing force of storms. We came on a number of fresh goat-tracks in the snow or the soft shale. These are the reverse of the mountain sheep, the V which the hoofs make having its open end in the direction the animal is going. There seemed to be several, large and small; and the perverted animals invariably chose the sharpest slant they could find to walk on, often with a decent level just beside it that we were glad enough to have. If there was a precipice and a sound flat-top, they took the precipice, and crossed its face on juts that did not look as if your hat would hang on them. In this I think they are worse than the mountain sheep, if that is possible. Certainly they do not seem to come down into the high pastures and feed on the grass levels as the sheep will. As we continued I saw a singular looking stone lying on a little ledge some way down the mountain ahead. I decided it must be a stone, and was going to speak of it, when the stone moved and we crouched in the slanting gravel. . . . I climbed or crawled out of sight, keeping any stone or little bush between me and the goat, and so came cautiously to where I could peer over and see the goat lying turned away from me, with his head commanding the valley. He was on a tiny shelf of snow; beside him was one small pine, and below that the rock fell away steeply into the gorge. He looked white, and huge, and strange; and somehow I had a sense of personality about him more vivid than any since I watched my first silver-tip lift a rotten log, and, sitting on his hind legs, make a breakfast on beetles, picking them off the log with one paw."

Mr. Wister says of the habits of the goat: "It has been stated that in the winter season, like mountain sheep, he

descends and comes into the valleys. This does not seem to be the case. He does not depend upon grass, if indeed he eats grass at all. His food seems to be chiefly the short, almost lichen-like moss that grows on the faces and at the base of the rocks and between them in the crevices. None of the people in the Methon country spoke of seeing goats come out of the mountains during winter. I have not sufficient data to make the assertion, but I am inclined to believe that the goat keeps consistently to the hills, whatever the season may be, and in this differs from the mountain sheep as he differs in appearance, temperament, and in all characteristics, excepting the predilection for the inclined plane; and in this habit he is more vertical than the sheep." Of hunting them he adds: "There is no use in attempting to hunt them from below. Their eyes are watchful and keen, and the chances are that if you are working up from below and see a goat on the hill, he will have been looking at you for some time. Once he is alarmed, ten minutes will be enough for him to put a good many hours of climbing between himself and you. His favorite trick is to remain stock-still, watching you till you pass out of his sight behind something, and then, he makes off so energetically that when you see him next he will be on some totally new mountain. But his intelligence does not seem to grasp more than the danger from below. While he is steadfastly on the alert against this, it apparently does not occur to him that anything can come down upon him. Consequently from above you may get very near before you are noticed."

PART II

GLIRES

(GNAWING ANIMALS)

GLIRES

(GNAWING ANIMALS)

(S. & C.)

The rodents, representatives of the order GLIRES, are gnawing animals easily recognized by the peculiar arrangement of their teeth. In front are the incisors, two in each jaw, which meet vertically like chisels and form a powerful apparatus for gnawing or cutting. The remaining teeth are broad, flat-topped grinders (molars) placed in the back of the mouth. The gnawing teeth are peculiar in being curved and deeply rooted in the jaws, while they also grow continuously from the base so that they never become worn out.

Rodents exhibit great diversity: some are burrowers, as the gophers and marmots; others are terrestrial, others aquatic (muskrat), while one species (flying squirrel) even navigates the air. With their many differences of structure all rodents are to be recognized by the characteristic "gnawing teeth" which remain the same in all.

I

SQUIRRELS AND MARMOTS

Family *Sciuridae*

(S. & C.)

Squirrels and their allies include some of our best-known rodents. As a rule they are active, intelligent animals, with large bright eyes, bushy tails, and strong, muscular legs. Some species are burrowers, others, comprising the most typical squirrels, are climbers, scaling the tree trunks or traversing the most slender branches with equal agility. Arboreal habit reaches its highest specialization in the flying squirrel which launches forth in parachute-like flight from tree to tree, despising the support of slender branches upon which the other squirrels still rely. When one watches the sudden leaps from bough to bough of the red squirrel, the evolution of the flying squirrel can easily be understood.

1. Red Squirrel

Sciurus hudsonicus (Erxleben)

(Also called *Chickaree*)

Length—12 inches.—(S. & C.)

Description—In winter back and upper side of tail bright chestnut; sides olive gray, the hairs banded with black; under parts grayish white. In summer no distinct

rufous area on the back, and lower parts pure white with a black stripe on each side, separating the colors of the upper and lower parts.—(S. & C.)

Range—Southern Maine, Nova Scotia, and Quebec and in the mountains southward, replaced in the lower grounds and in Labrador by slightly different varieties. In other parts of the northern continent ten variations from type are known and have been recorded.

—(S. & C.)

The special and preferred environment of the common red squirrel is in coniferous woods. The home range of the individual is quite small, and when food is abundant, a red squirrel may pass his natural life in a very few acres of ground. If driven a half mile away from home in search of food he will probably find himself in unknown territory. The species is never seen in vast numbers as are the gray squirrels. Where there are neither cone-bearing trees nor oaks there are not likely to be red squirrels.

Red squirrels are sociable animals, playing together and chasing each other vigorously among the trees. They do not, however, unite to defeat a common enemy or to undertake a piece of work too heavy for one. This squirrel chatters a note of alarm at the sight of a foe, but his note seems intended as much as a menace to the enemy as a warning to friends. Prolonged chatter, repeated coughing and scolding, and the deep whining that precedes the chatter are characteristic of the red squirrel wherever found.

The home nest is usually in a hollow tree or stump, often in the abandoned holes of the flicker. In some districts there are many outside nests, usually strips of bark and

roots arranged high in the top of some bushy tree. Mating takes place in March or April. The evidence is not as yet conclusive as to whether the sexes truly pair or simply consort for the time being. The young are born probably about the first of May, five or six to a litter. In June the little ones often follow the older in a sort of procession through the trees. This is no doubt their training, the mother teaching them the leaps and bridges and the places of harvest in their overhead world.

Red squirrels have very tender tails. If lifted suddenly by the tail, the skin is likely to strip off, leaving the raw, bony structure. A tailless squirrel seems rarely to survive. The loss seems to limit the jumping power, and when the animal falls, deprived of its parachute, it often receives a serious jar. The wonderful leaps that astonish us humans are always made on a descent and are greatly aided by the kiting action of the flat-spread body and tail. It is probable that five feet is about the limit of a leap on the level.

Red squirrels are sturdy swimmers when occasion arises, swimming rapidly with much of the head, back, and tail out of water. There are well-authenticated reports of red squirrels crossing from the western to the eastern side of Lake Champlain, a distance of seven miles, in search of chestnuts that grow abundantly there.

In the summer the little animals feed on various sorts of nuts and seeds. Squirrels are sometimes unaccountable in tastes, tearing open large quantities of early apples to get at the seeds and yet again partaking liberally of the pulp and leaving the seed untouched. Red squirrels have acquired a very bad reputation for their attacks on fledgling birds and on birds' nests. Yet there are well-

authenticated instances of these hungry little animals living in quite near proximity to growing birds without offering harm.

Autumn sees every member of the squirrel tribe out feasting and gathering his and her store of nuts and cones for winter use. The red variety is thought never to bury separate nuts here and there in the ground as does the fox squirrel, but carefully arranges its prepared food in no more than one or two storage places. The squirrels know the best way of getting at each particular kind of food. A squirrel never opens an acorn as it would a hickory nut, or a pine cone as it does a chestnut burr. It never makes the mistake of boring into a nut that does not repay trouble. Sound-looking nuts picked up among chaff left by squirrels will invariably be found to be empty. The reason why squirrels cut off chestnuts before they are ripe is somewhat puzzling; probably he reasons from the seeds of the conifers which, to make sure of, he must harvest just before they are ripe.

How the fox and gray squirrels that hide food casually in a dozen different places remember how to locate their treasure trove has always been somewhat of a puzzle. Probably the animals have a special guidance of smell; close observers have noted that whereas the squirrel seldom digs without finding, he quite often smells without digging. As showing the different instincts of the gray and red squirrels, the gray, if fed from a tray, will sit down and eat the food where they find it. The reds take everything away. And whereas the gray when filled to repletion has no further interest in food, the frugal red will carry away and hide for future use such as he cannot use for the moment.

Another large source of food supply for winter are mushrooms, chiefly of the genus *Russula*, which are stored high in the forked branches of trees where they will remain dry and also escape the ravages of other mushroom-eating animals. The squirrel's sense of private ownership does not seem so strong in tree-stored mushrooms as it does in hoards of nuts. A third important source of food supply is the thinnest greenish outer bark of the poplar tree. This he does not need to store, but merely gathers as he desires it, chiefly in time of famine.

Red squirrels probably do not hibernate. They have been seen repeatedly chasing each other about in the coldest of clear winter weather; probably during severe storms they are forced, much against their wills, to remain quiet a few days. Even then there may be found things to do. Where red squirrels abide tunnels are often found driven here and there through the snow, always quite near the ground. Sometimes these tunnels seem to be entirely for amusement and exercise; others, apparently judging from bits of pine cones that may still be found scattered about, have been bored for reasons connected with the food supply.

In primitive regions the greatest enemy of this little chatterer is the pine marten. Quick as is the squirrel, the marten is right at his heels. From a foe as speedy as himself our little friend has but two chances of escape. He may think himself safe in a snug hole, but the marten may merely tear open a wider entrance. The most usual means of escape is by the jump from tree to tree. The marten can also jump, but being a heavier animal must jump farther back on each limb. Therefore, if the red squirrel sticks to the long jumps with which he is familiar

he is often able to make his escape. But amid unfamiliar trees he becomes easy prey. The weasels that will follow him into any hole are also very dangerous enemies: and to these must be added various hawks and owls. Nevertheless, the red squirrel manages to thrive!

Rodents are rated low in the scale of intelligence, but the red squirrel ranks high in its class. The red squirrel will fight bravely for his food tree, for his nest, and for his mate. Caught trespassing on the domain of a neighbor, he is likely to act in a cowardly manner quite in contrast to his behavior on other occasions. The "red" is endowed with burning curiosity, is an inveterate scold, and will follow a foe merely for the fun of abusing him at a safe distance. He considers himself much superior to his big cousin the gray squirrel, over whom he more often wins by vigor and aggressiveness than by any actual battle. He is lively, mischievous, a "veritable Puck of the Pines."

Yes, but what of the grain, the fruit, and the number of song birds he destroys every year? The red squirrels should undoubtedly be kept from growing too numerous, particularly since their natural enemies, the martens, are extinct in most sections of the country; but there are many who, as they strolled about home grounds or drove down quiet country lanes, would miss the sight of the noisy little rascals skipping along walls and fences!

II. Gray Squirrel

Sciurus carolinensis (Gmelin)

(S. & C.)

Length—18 inches.

Description—Similar in build but not as large as the fox squirrel. Yellowish gray, individual hairs banded with

rusty yellow and black, decidedly rusty on the face, feet, and sides; below white; hairs of tail rusty-yellow at base, black in the middle with white tips.

Range—Florida to southeastern Pennsylvania, Hudson Valley, Indiana, and Missouri; farther north and west replaced by slightly different varieties.

The habits of the gray squirrels vary but little whether their home is in a deep forest or in a city park close to the haunts of men. Finding a suitable hole in a tree they immediately set to work to enlarge it to suit their tastes. Often a half dozen will occupy the one hole, and, though old males sometimes become obstreperous, the "grays" seem to get on reasonably well one with another. If convenient holes are not available, they make nests of leaves in the forks of trees; they cut off green leaves in branches and arrange them in successive layers on a rough platform in such a manner as to shed the rain perfectly and remain warm and cosy inside.

Gray squirrels are quite tameable and with a bit of cake or a few nuts for enticement will quickly learn to visit a room if the window be left a little way open, or to play about a protected veranda. Even in sections where they are looked upon as legitimate game they lose much of their fear of man during the close season of spring and summer.

Gray squirrels warn each other of danger with a sort of flat rasping bark turning into a whiney snarl that is audible a surprising distance in calm weather. And many dangers there are: in the wild a host of natural enemies; in semi-domestic surroundings, the cat, the ubiquitous dog, and sometimes even the small boy.

In the wild, hawks are most dangerous of enemies, all

the more so because their hunting periods—from sunrise to ten o'clock in the morning and from three to nearly sunset—correspond with great exactness to the hours when the gray squirrel skips about in search of food. Hawks from above gaze down on the foliage from constantly varying positions, watching for anything that resembles the flicker of a bushy tail. Or if the gray squirrel absent himself from home for too long periods his garnered stores will be pilfered by mice or his thieving relatives, the red squirrels. Gray squirrels also seem quickly to learn that in the autumn young men and boys who stroll about with shotguns are to be avoided.

Their relatives, the fox squirrels, are big, vigorous fellows who, living in warmer regions, prepare smaller stores of provisions, sometimes scarcely any at all, against the deadness of winter. The gray squirrels are comfort-loving, too, but have little opportunity to indulge their tastes, being always mindful of the days and days when all nourishment will be hid by the heavy blanket of snow.

The fox squirrels live mostly in hard woods. Here they build nests of dry leaves or live in holes of big trees which they are careful to line with dry grass and strips of soft bark. They live in the tree tops of the Southern pines, and the scales of pines scattered among the needles are signs for which the squirrel hunter eagerly searches.

These squirrels are seldom seen about in rough weather. For a time at least they prefer to go hungry rather than to face the cold; eventually, no doubt, if they lived farther north, hunger would finally drive them forth. When the sun shines they gather wild fruit, berries, mushrooms, and, later, acorns, hickory nuts, and ripened grains. They grow to be big, vigorous fellows, the largest of the species,

and are much hunted as an article of food. They are heavy and well-flavored, but it requires skillful watching and much persistence to bring home a good bag of fox squirrels.

A full-grown animal has little to fear from hawks, except perhaps after an unusually hard winter, but raccoons and wild cats undoubtedly account for a good many in sections where these animals abound.

There are several varieties noted in various sections of the South and West. No detailed investigations are available, but it is presumed that they breed in about the same number and at about the same time as do other species.

III. Chipmunk

Tamias striatus (Linnaeus)

(Also called *Ground Hackee, Ground Squirrel, Striped Squirrel*)

Length—9.50 inches.—(S. & C.)

Description—Head brown, back grizzly gray, rump and hind legs rufous chestnut; a narrow black stripe on the middle of the back from the ears to the rufous of the rump, and on each side two black stripes with a light buff stripe between them. Sides of the body buffy mixed with black-tipped hairs, below white. Tail grizzly gray above with black tips to the hairs, below rufous edged with black.—(S. & C.)

Range—Southern New York to Georgia. Northward the closely related northern hackee takes its place. The northern hackee is much brighter and lighter in color, bright rusty red instead of chestnut above. Numerous other species are found in the West.—(S. & C.)

The name *Tamias* (the steward) was given the chipmunk on account of its foresight in laying up provisions, and it is the picture of a small animal scampering off with bulging cheek pouches that we think of when we hear the name. The gray squirrel stores his food in numberless places, scarcely more than a single nut in each. The red squirrel has no more than one or two hiding places all arranged so as to be accessible regardless of frost or depth of snow. Observations tend to prove that the chipmunk follows both methods.

The chipmunk will carry in his cheeks—certainly a maximum weight—four hickory nuts at a time, and his burrow is so small that, when heavily loaded, he must sometimes turn sidewise to accomplish an entrance. Sound nuts and acorns are what is wanted and vigorous raids are made on grain seeds when available. The chipmunk labors so valiantly and to such good purpose that sometimes in the spring with the return of warm weather he is found to have still on hand abundant unused supplies.

Log-heaps, stone piles, wooded banks, ramshackle outbuildings, always in dry sunny places near lowlands, are selected by preference for abiding places. Only slightly arboreal in habit, the chipmunk will not be found in gloomy, unbroken forests nor in wet lands. These cheerful little rodents are great lovers of sunshine, sociable as well as gregarious. They prefer to associate in numbers when surroundings are attractive, and at times several pairs occupy the same burrow in winter, the store of food being common property.

The home range must undoubtedly be very small. Probably a chipmunk, if unmolested, will spend its entire

life within the compass of two or three acres. Evidence is not conclusive as to whether the little animals are at any time migratory. Chipmunks are so much more in evidence in certain localities during good nut years, and so little in evidence in an autumn when nuts are few, that the presumption is at least raised that the animals may be migratory. However, until some naturalist reports having actually seen a migration of chipmunks, the question can scarcely be considered settled.

The chipmunk is among the most musical of animals and besides its loud and most usually heard "*chuck-chuck*," it has other notes, particularly a trilled whistle in several different keys that it utters when alarmed. It is believed that both sexes sing.

The regularity with which the chipmunk appears above ground in the first warm days of spring has often been remarked upon. Some chipmunk, mounted on a log or root, starts a loud, chirpy "*chuck-chuck-chuck*." Other chipmunks, as if only waiting the signal, rush from their holes, and add their loud and vigorous "*chuck-chuck-chuck*" to the spring salute. So the clarion sounds through the land of the chipmunk!

In the wooded parts of Minnesota the young Indian boys were in former days accustomed to celebrate the coming forth of the chipmunks by a special hunt. The boys went forth to the haunts of their victims between sunrise and nine o'clock on a suitable sort of a morning. One of the boys, adept in imitating, starts the chorus with a loud "*chuck-chuck-chuck*." The chipmunks pop out of their holes on all sides and quickly fall in desired numbers to the blunt-headed arrows of the little Indians.

There is very little known regarding the mating of

chipmunks. It is probable that there are two broods produced a year and periods of sexual excitement in spring and autumn. The young number four or five and are, at the start, blind, helpless, naked, and almost shapeless. It is thought that the female alone cares for the young. By June they are sufficiently grown to venture up to the open air. By August young chipmunks are mostly fully grown and able to shift for themselves. The three or four individuals commonly found in the winter den are thought to be the family of that year.

The chipmunk employs a variety of ingenious methods to conceal the entrance to his home. Beginning at a convenient point in a selected bank, he drives a long crooked tunnel with an outlet at some distance. The calibre of the burrow is one and a half or two inches. All material excavated is carried off to considerable distance. Some naturalists believe that the animal carries off the dirt in its cheek pouches, but this is in no way proved.

Extraordinary instances of pertinacity of chipmunks have been reported. In one case a chipmunk had decided to have an entrance to its burrow from a point in the middle of a driveway. As many as sixteen times in one month was the burrow opened up by the chipmunk working from below, and as many times closed by man with hard-packed gravel from above. Eventually man went away on a vacation and the chipmunk won out! Unlike their relatives, the woodchucks, they are tenacious of their property. Where a chipmunk is to be found this year, there will be found another, or more likely the same inhabitant, the following summer.

A den opened up by Kennicott in November had for storage "four or five enlarged chambers in different parts

of the burrow, which was complicated and consisted of several windings and intersected passages situated not more than a foot below the surface. The entrance to the burrow was under a log and the passages extended several feet on every side. A large nest of leaves and grass was placed above the surface under the rotten log."

The chipmunk is very inquisitive by nature with the voice and vivacity of the bird. There is something very attractive about the little animals who make us forget their rat-like traits, their rifling of birds' nests and slaughter of young fledglings.

The chipmunk is not so arboreal as the red squirrel. It seldom climbs far from the ground and then only for food or for refuge. Among its enemies are cats, foxes, weasels, hawks, and snakes. The weasels follow the chipmunk into his hole and from them he has devised but one certain method of escape: sometimes he is able to retreat to a side gallery and then carefully plugs the passage behind, thus eluding the bloodthirsty enemy who has many times been known to kill every member of a burrow.

The chipmunk's autumnal disappearance seems timed entirely on the vigor and promptness of autumnal frosts. He may retire in September, or in a very mild season may stay up above ground until well into December. Torpor is thought to be not as profound as with many animals: a few days of bright, warm midwinter weather are quite likely to tempt him forth, and it is quite possible that, unless the thermometer drops very rapidly, he will not go back into deep sleep again.

Most animals which hibernate grow enormously fat just before retirement. The reason why the chipmunk does not do so is somewhat of a mystery: possibly it is

because of their lighter sleep; but this, too, seems to vary somewhat with latitude, being much heavier in Canada than in regions farther south.

IV. Little Chipmunk, Long-Tailed Chipmunk

Eutamias quadrivittatus neglectus (Allen)

Length—About 8 inches. Tail, 4 inches.

Description—In general, above a brownish gray, much darker on the crown, faintly peppered with dark brown on crown, back, and haunches, and becoming clear orange-buff on the shoulders, sides, and flanks; chin, throat, lower jaw, and under parts white. Five black stripes on the body, the central stripe being the longest; stripe begins on the crown and continues to the tail; between the two outer black stripes on each side is a white stripe which dims on the neck but reappears at the ear and continues to the eye. On each side of the head are three dark brown stripes—over the eye, through the eye and under the eye. The tail is dull orange below and above orange overlaid with black hairs. It has a black edging or border which is broadened toward the end, and is tipped all round with yellow or buff.

Range—This chipmunk is a western species slowly working eastward. It is very abundant in the northwest and British Columbia, becoming less frequent as one proceeds east.

Its quick movements and noisy "chirrup," its warm fawn color and black stripes mark the little animal as a chipmunk. Smaller size and upright tail distinguish it from *striatus* and complete the identification. Naturalists distinguish six different variations from type.

This species selects the same surroundings as the large chipmunk and is probably confined to fully as small an individual range. As a species the chipmunk seems less able to transport itself from place to place than are many trees and plants. As usual in such cases the group has become as a result split up into a number of different forms presenting only minor variations.

The little chipmunk of the Rockies is thought by some to be hardier than *striatus* of the East. The habits and actions of these vigorous little animals have been described in admiring detail by many travelers and naturalists. We quote Miller Christy:

"Without exception the chipmunk is in its form and movements the very prettiest little animal I ever set eyes on. In it the fear of man seems to be entirely absent: it seems to run away merely for fun, but for all that, you would almost as easily catch a flash of lightning! It is incessantly upon the move, climbing above and over everything as if exploring, and always carrying its long tail bolt upright in such a ridiculous manner that it becomes by far the most conspicuous part of the whole animal. You may see one of these tails with a chipmunk attached to it, dodging round a piece of wood and eyeing you keenly, without the slightest appearance of fear, as if roguishly trying to tempt you to catch it. But try! In a moment, with a shrill, derisive, bird-like little whistle, the tail is gone—you hardly know where, till you see it again a moment later, going through the same antics along with several other tails."

In August and September the chipmunks labor vigorously to gather winter supplies of grains and seeds of various weeds and wild fruits. Miller Christy, already

quoted, reports the discovery of a nest built of feathers and soft vegetable fibres, at the end of a tunnel under a clump of bearberry. "The tunnel was about two feet long and terminated a foot or more beneath the surface in a chamber about the size of a cocoanut. This chamber was completely filled by the nest, which contained, in addition to its occupant (this was on October 23), a small store of seeds of various weeds and wild fruits."

By the end of September in northern Canada, later farther south, the chipmunk has plugged its door way against the cold and curls up for its six-months' slumber.

V. Franklin Ground-squirrel, Richardson Ground-squirrel

Citellus franklini, Citellus richardsoni (Sabine)

(The Franklin is also called *Gray Gopher, Scrub Gopher, Whistling Gopher;* the Richardson is also called *Yellow Gopher, Flickertail*)

The genus *Citellus* comprises squirrel-like animals that live on the ground, with tail more or less bushy and usually long, outer ears various, from almost none to large, well-developed cheek pouches; five nearly equal toes on hind foot; four fingers and knob-like thumb in front.

Length—14 inches (Franklin). 12 inches (Richardson).

Description—Franklin. Hair coarse and harsh, gray above suffused with yellowish brown and hairs banded with black; below paler gray with a white throat, tail clear gray.

Richardson. In general warm yellowish buff, deepening along the cheeks, shoulders, flanks, and thighs to a

strong yellow; on the crown and back thickly peppered with brownish black; on the rump these markings suggest cross penciling. The tail above is brown, peppered like the back, below clear pale sienna, finished with a blackish edging which again has a broad tipping of pale yellow.

Range—Franklin. Saskatchewan south to eastern Kansas and through northern and middle Illinois and southern Wisconsin to the western border of Indiana.

Richardson. Similar except that the range does not extend as far south, the animal not being found at any great distance below the International Line.

The gray ground-squirrel (Franklin) is not as prolific as the yellow Richardson ground-squirrel. The gray ground-squirrel is essentially a ground animal, frequenting the edges of thick dry undergrowth near woodlands. It will not be found in dense forests or on open prairies.

As usual with squirrels the home locality covers a very narrow range. The gray ground-squirrels usually live alone or in pairs; yet they appear to be by nature gregarious: it may be merely because of their much smaller numbers that they do not form the little miniature villages of the striped variety.

The den is made in a low, brushy bank and several observers have thought it to average deeper than that of other members of the family. This is the musician of the ground-squirrels. Its calls do not vary in character, but are notably louder, clear, more musical.

The slight evidence at hand would set the mating season at about the middle of May. There is but one litter each year.

This is a very active little animal. Even a terrier will have small luck in pursuing a gray ground-squirrel through its favorite undergrowth. It seems well established that this rodent is a depredator of chicken roosts when opportunity arises and that it uses its mentality—it is far more quick-witted than the yellow ground-squirrel—at all times for the procurement of flesh, chiefly mice and small birds.

The Richardson, or yellow ground-squirrel, grouped with the gray ground-squirrel for convenience, is quite strictly a prairie animal. This is the most abundant of the species and a vivid picture is presented by Coues of the animal along the International Boundary Line in 1875.

"It is one of the most abundant animals of our country occurring by hundreds of thousands over as many square miles of territory almost to the exclusion of other forms of mammalian life. Millions of acres of ground are honeycombed with its burrows. . . . I never saw any animal—not even buffalo—in such profusion. I have ridden for days and weeks where they were continuously as numerous as prairie dogs in their populous villages."

This, it will be noted, was written in 1875. Since then a safe and successful method of extermination by poisoning with crude bisulphide of carbon has been disseminated far and wide by the United States Biological Survey, with the effect that the number of animals has been kept down within somewhat reasonable bounds.

These yellow gophers appear above ground each year about the middle of April without regard to weather. Late snows do not cause their return to their burrows, but make them prominent objects as they skip about the white expanse in search of food. These animals dig their

holes in scattering colonies in sociable fashion. They are never known to combine their efforts in any common cause. The husky alarm whistle as the individual scents danger is, however, understood by all and appropriate action taken. Of this ground-squirrel as of the prairie dog, it may be said that "the voice is tied to the tail." When the animal lifts the one, it lifts the other, and when the one is lowered, so is the other.

The young are born about the middle of May from six to eleven in number, after a period of gestation estimated to be between twenty-one and thirty days. By the end of June the young are a third grown and by September they are not to be distinguished from their parents either in activity or appearance.

The yellow ground-squirrel seems not to have the spirit of its relative, the gray variety, or of the striped gopher. Though the largest in size, the yellow squirrel was bullied by both of its mates when all three were kept together in a cage. They are also poor runners, and if surprised at any distance from their burrows are easily disposed of by the farmer's boy or by his dog.

Little subtlety is needed in trapping these creatures. The ground-squirrel plunges into his hole as you approach. Set the trap by the entrance without bait or covering. In a minute Mr. Ground-squirrel pops his head out once or twice, then boldly leaps out. If he overleaps the trap, a clod hurled at him sends him back in such haste as surely to encompass his ruin. If he is slow in coming out, a low whistle will often encourage him.

These ground-squirrels seem to carry food home in their cheek pouches for immediate consumption as well as for winter stores. They are mischievous throughout the

entire season and some naturalists believe that their damage to newly planted crops, the seeds they dig out of the ground, to be even more serious than their ravages amid the ripened grain. August and September find the little intruders working at top speed to complete their own winter preparations. Load after load of golden grain is carried and carefully packed away in the owner's small private granary. As the ground-squirrel goes to sleep in October, these supplies are considered to be for use when he rises from his winter sleep. Then he will be immediately possessed of great hunger and yet the situation outdoors will be for some time quite unpropitious.

VI. Striped Ground-squirrel

Citellus tridecemlineatus (Mitchell)

(Also called *Striped Gopher*)

Length—10 inches.

Description—Back striped with six buff bands and seven wider brown bands, each of the latter containing a row of small white spots; middle bands running from the top of the head to the tail, others shorter; lower parts dull buff; tail rather short, flat, and rather bushy.

Range—Plains of the Saskatchewan; south to Texas and east to southern Wisconsin and Michigan, nearly the whole of Illinois, northern Indiana, and northwestern Ohio.

The favorite habitat of the striped ground-squirrel is dry virgin prairie on a light soil. Its burrows are small and superficial and therefore usually destroyed completely by the passage of the plough. In ploughed fields the yellow *Richardsoni*, with deeper burrows untouched except at

the entrance, survive where the striped variety has entirely disappeared. The fact of the varying depth of burrow is probably more to the point than the belief of the farmers that the larger squirrels kill the smaller striped species.

These burrows are of at least two kinds: a labyrinth of many galleries and entrances, rarely more than a few inches under the sod; this is apparently intended as a playground and refuge, also to throw pursuers off the trail of the real nest which is lower down, a comfortable chamber about nine inches in diameter lined with fine dry grass. The nesting chamber has also many approaches and more than one entrance.

The striped ground-squirrel has a much greater variety of whistles and bird-like chirps than the yellow species. Its short sharp whistle of alarm and its prolonged quavering defiance are well known to farmer boys in ground-squirrel-infested regions. A striped gopher seated before its burrow waits till you are perhaps within ten feet, then dives with a little defiant "chirrup." If you pass within eight or ten feet without looking at him, he will watch you but is quite likely not to dive at all. The yellow ground-squirrel, on the contrary, makes a nervous jump for its hole as soon as it sees man anywhere in the offing.

This gopher has the habit of sitting bolt upright on a mound; it makes itself as tall as possible; its paws are pressed in close to its breast; at a distance it seems for all the world like a stake driven into the ground. But on approach the supposed stake suddenly disappears!

This little upright creature is of uncontrollable curiosity and is easily caught by laying a noose on the hole when it first disappears.

The species is very partial to warmth and is scarcely to be seen above ground except when the sun is out in full strength. Striped squirrels in cages are put into torpor by a temperature near the freezing point which seems not to affect the yellow squirrels in the least. The striped, by rising nearly two weeks later from winter slumber and by retiring two weeks earlier in the autumn, loses one month out of the twelve that humans devote to active life.

Detailed investigations show that the striped gopher disposes of an enormous number of mice, grasshoppers, beetles, caterpillars, ants, etc., and indicate that the bounty laws as against this animal at least are probably not as well-advised as farmers think. Kennicott after careful investigation declares: "The high probability is that their good offices in the destruction of these (meadow mice and insects) far more than counterbalances their occasional injury to the cornfields. I doubt of their being so very injurious in long-cultivated farms."

The long, slender, weasel-like body is not misleading as to its character. The striped ground-squirrel is, indeed, the weasel of its race, and daily combs its small acre of territory in search of eggs or the defenceless young of prairie birds. There is far too much testimony that on occasion the little rodent is cannibalistic, not hesitating in times of stress to kill and eat wife or brother, mother or child.

This ground-squirrel stores food at all seasons when it is possible to do so, though the necessity for this is not quite manifest. Canny wisdom is shown in the selection and, though taste be multifarious, nothing of a spoilable nature is ever stored.

These stores consist of grain, seeds, roots, and all are housed in large chambers excavated for their reception along the sides of the burrow. Corn, wheat, and oats are taken from newly planted fields in the spring, buck and winter wheat later in the season, and heads of ripened grain in harvest time. Kennicott reports a striped gopher who had more than a quart of crab apples which he had carried from a tree several rods distant.

As the ground-squirrel takes no nourishment during the long winter torpor, it must be that this is his spring reserve, preparation for days of cold rains and backward days when it is preferable to stay below in the warm ground. Parasitic mice make at times vigorous pilferings of these stores and as generations of ground-squirrels have risen and fallen the little animals have learned the desirable safety of an over-supply.

Curiously enough, these rodents are thought never to drink water, the moisture of the vegetable products they eat being sufficient for their small needs. I kept a number of ground-squirrels in a cage over summer and after a continued hot dry spell tempted the captives with a saucer of water, but without result.

The badger, among the preying quadrupeds, makes a specialty of ground-squirrels as diet, and hawks keep a constant eye for those who stir too far from their holes. The badger is particularly destructive, ripping off the covers of burrows for a distance of twenty or thirty yards in his efforts to reach the hidden inmates.

Cats kill gophers but seem to court destruction by doing so; for the ground-squirrels are much affected by abdominal and intestinal parasites which, taken into the cat's system, quickly dispose of the domestic animal.

VII. Flying Squirrel

Sciuropterous volans (Linnaeus)

Length—9.40 inches.—(S. & C.)

Description—Fur soft, dense, and mole-like, skin of the sides produced and susceptible of being spread out when the legs are extended, so as to form a sort of parachute. Drab above, irregularly tinged with russet, slightly brighter in summer, under parts pure white to the roots of the hair.—(S. & C.)

Range—Northern New York and southern New England to Georgia and west to the plains. A slightly different variety replaces this in Florida, and in the northern part of its range there occurs a much larger, quite different species.—(S. & C.) *Sabrinus*, the northern flying squirrel, is larger, being about twelve inches long of which the tail is six.

The flying squirrel is more abundant than is commonly supposed. Its nocturnal habits lead many amateur observers to believe that it is not located in their vicinity even at times when it is the most numerous of the squirrel group.

Flying squirrels are invariably found near large timber where hollow trunks or woodpeckers' holes afford a resting place. Presumably as with others of the species the home range is confined to an acre or two, but on this we have little direct testimony. The hardiness of this night prowler is such that, although it ranges northwest as far as the Arctic Circle, it is not known to hibernate at any time. In the Far North spruce seeds are probably its chief food and there is little doubt that the flying squirrel will eat

bark, buds, fruit, and, of course, when obtainable, small birds and insects. Prompted by hunger or by curiosity of which he has his full share, he examines every object unknown to him with the result that he is most often found in traps set by hunters for valuable fur-bearing animals.

The cry of the flying squirrel is a prolonged squeak not unlike the complaint of a red-eyed vireo whose nest is threatened. Most naturalists are of the opinion that the species pairs and that the male takes an active interest in the young.

These number usually from three to six and are born about the last of April. Audubon and Bachman mention a touching instance of maternal devotion which is also corroborated by other accounts.

"This brood was procured as follows: a piece of partially cleared wood having been set on fire, the laborers saw the flying squirrel start from a hollow stump with a young one in her mouth and watched the place where she deposited it, in another stump at a little distance. The mother returned to her nest and took away another and another in succession until all were removed, when the woodcutters went to the abode now occupied by the affectionate animal, and caught her already singed by the flame of the fire and her five young unscathed."

The usual enemies of squirrels—owls, foxes, martens, weasels—are also the enemies of this gentle creature. Unlike the daytime members of the family, the night squirrels seem to be poor swimmers. So many night squirrels have been found dead in wells and cisterns that it is apparent that ability to fly through the air implies no mastery of the water.

But the flying squirrels' characteristic performance

cannot really be called flying. Alighting from a tree trunk they always go upward, scrambling and jumping till they reach the topmost branches. From here they launch forth in their parachute-like descent, their legs stretched to the utmost, so as to extend on either side the folds of skin to which they owe their power of sailing. They really only glide downward until just about to come to rest, when by a deflection of the body they are enabled through their momentum to shoot up diagonally a few inches and grasp the tree trunk, ready for another climb. As for distance, they are said on reliable authority to sail from the top of a tree to the bottom of another fifty yards away.—(S. & C.)

VIII. Woodchuck

Arctomys monax (Linnaeus)

(Also called *Ground-hog*, *Marmot*, etc.)

Length—24 inches.—(S. & C.)

Description—Heavy and thick-set, with short legs and rather short brushy tail. Grizzly or yellowish gray varied with black and rusty, under parts rusty, feet black.—(S. & C.)

Range—New York and New England to Georgia and North Dakota, represented northward by an allied variety. Other varieties westward.—(S. & C.)

Popular superstition of unknown origin has it that the woodchuck arises from his winter torpor on February 2d. He comes to the surface and if *he then sees his shadow on the snow*, he retires for another six weeks' slumber; but if no shadow is visible, he continues more or less actively above ground till spring.

It is true that among ground animals the woodchuck arouses himself earlier than most, sometimes as early as the first week in February. And it is also true that having looked about he may go back to his den again. But probably not for long, certainly not to sleep for any stated period. The animal is rather unaccountably erratic in the matter of hibernation: he seems often to retire for the season while the sun still casts considerable warmth, and to push his way to the surface while the ground is still buried in several feet of snow. Certainly one look at continuing winter is seldom sufficient for him. The woodchuck makes long journeys easily traceable and apparently aimless to and fro till eventually fresh sprigs of grass preserved under their snow covering become available and are eagerly nibbled.

The woodchuck is a forest animal but one that decidedly prefers sunny spots and high dry situations. Clay banks and gravelly ridges, grain fields still dotted with stumps, are the places where this marmot flourishes and waxes fat. Tracks and the destruction in the vicinity of the den show clearly that the home range of the individual is quite unlikely to exceed one hundred yards.

The woodchuck's existence clusters about his home, the location of which he selects with the greatest of care. He will go quite a distance in search of a new location—a new den each spring seems to be the woodchuck theory—but once settled he will roam no more. He digs at tremendous speed until the job is finished; but after that it will seldom occur to him to remodel or extend in any fashion.

The burrow or den consists of two principal types. That most frequently seen slopes at a moderate angle

from the surface and has a mound of dirt near the entrance. A careful investigation of nine burrows made by Walt Fisher of Cincinnati, Ohio, gave the deepest point reached by any burrow 49 inches down. Burrows at the entrance were 18 inches, sometimes larger; but all quickly narrowed to a diameter of no more than six or seven inches. Most burrows had two or three entrances, a few only one. A few had no earth pile, being holes excavated in previous years as was shown by the increased height of surrounding vegetation. The mounds of dirt were usually employed for posts of observation, for which they were admirably adapted, the largest being four feet nine inches by four feet eleven inches by nine inches high.

In contrast with the struggle for existence of many other animals, the woodchuck's life seems one of luxurious ease. Soon after sunrise, while the dew is still on the grass, he comes out to get his breakfast. At noon he lolls in the sun before his doorway. Toward evening he strolls forth again leisurely, moving along the paths he has made in and out amongst clover, or grain, or sometimes even garden truck, nibbling here and there as fancy dictates. As food is so near by and as he walks only in search of it, he becomes by October fat to at times an almost ridiculous state of obesity. Well-fed, unafraid, reveling sensuously in the warm sun, the woodchuck has been truly named the philosophical "red monk" of the fields.

The animal is but slow of movement. If surprised in the open, he tries desperately with vigorous bounds to reach his den: but if at any distance boy or dog should be able to head him off without difficulty. Occasionally in desperation he will climb a tree. In order to climb, the woodchuck must take advantage of the impetus of a

rush. He cannot start up the trunk of an upright tree and climb more than a few feet without falling. At best he poises himself uncertainly and is likely to tumble over to destruction. The animal swims but poorly and generally avoids water.

The almost universal testimony of observers is that one or two woodchucks (never more) are to be found in each home den. As to whether pairing takes place in the fall or in the early spring there is still uncertainty and expert opinion differs. The young are born about the end of April, usually four or five in a litter. They do not venture outside till mid-June and are quite probably blind till a month old. They take no solid food till they are able to go forth and search for it. As soon as they start on a diet of greenstuff they grow rapidly and by the end of August are nearly full grown. In case they do not depart on their own accord to take up life's venture, they are invariably driven forth by the mother about the time of early autumn. The female, which in early days has shown the customary mother's devotion to the young, grows curiously indifferent as the youngsters attain size and has even been known to purchase her own safety by pushing her offspring out of the burrow one by one to distract the attention of the dog that was trying to dig her out.

From September on the woodchuck stores food, not in storehouses which thieving members of his own race may discover and pilfer, but on his own person. Winter nests are also warmly lined and are located well below the possibilities of frost. When the woodchuck retires—often by the last of September—it is with the double assurance of a warm coat and of a warm bed. In a den through the

winter is usually a solitary animal very young or very old, or else a pair, perhaps a pair of last year reunited. The torpor of the animal is most profound. Audubon and Bachman tell of a woodchuck in captivity aroused after six weeks' slumber only with the greatest difficulty by being placed near an open fire and then, as quickly, curling up into a round ball when heat was removed.

If properly prepared, the flesh of the woodchuck makes excellent eating. The leather and skin which used to be put to a variety of small uses are no longer in much demand. In former days many flesh-eating animals must have been on watch for the succulent woodchuck who prowled too late or who wandered too far from the home nest. Nowadays, except for an occasional fox, about the only enemies he has are the farmer and the farmer's boy with his shotgun and the farmer's boy's dog. Where woodchucks have grown too numerous in fields desired for planting, science has come to aid with poisonous bisulphide gas which mercifully puts the animal into painless slumber from which he does not rise.

It is worthy of note that though the deer, the beaver, the porcupine have gone, the woodchuck still thrives in reasonable numbers. Without cunning, speed, strength, or armament that spell success in the animal world, the woodchuck has the secret of living close to the ground. So he still lives while other animals have deserted the ancient range never to return.

IX. Prairie Dog

Cynomys ludovicianus (Ord)

(Called also *Marmot*)

(S. & C.)

Length—15 inches.

Description—The ears are very short, and the tail very short and flat; color brownish above varied with gray and black hairs, soiled white below, tail black toward the end.

Range—Western Texas and Kansas to the base of the Rocky Mountains north to Montana. Allied varieties occur in Arizona, New Mexico, and Wyoming.

The prairie dog is perhaps the most characteristic animal of the higher drier prairies of the West. He reminds one of a miniature woodchuck, though much more gregarious and more active. Prairie Dogs associate in colonies or "dog towns," sometimes many miles in extent, where their burrows and mounds of excavated earth form a conspicuous feature of the landscape. Speaking of the occurrence of the prairie dog in Texas Dr. Kennerly says: "This interesting little animal never fails to attract the attention of every traveller on the western prairies; and an approach to one of their settlements, after long dreary marches, is always hailed with delight as a pleasant change from the monotony of lifeless scenes to one of cheerful activity and motion. Such occasions never fail to excite a certain degree of pleasure in everyone as he watches the motions of these curious creatures as they at first assemble in numbers, as if in grave consultation in

regard to the intrusion of strangers upon their quiet domain. Suddenly, upon the too near approach of apparent danger, they disperse; and each one, retiring to his respective home and standing upon the edge of his den, utters his peculiar bark as if in defiance; and then every one disappears and every voice is hushed when a single gun is discharged."

In all the older accounts of the prairie dog we inevitably find associated with him the rattlesnake and the burrowing owl, the three forming the theme for many a "Happy Family" story.

Apart from inhabiting the same region, and the fact that young prairie dogs form an acceptable article of diet for both the other members of the triumvirate, they have little to do with one another. The owls dig holes for themselves, though they may not be averse to appropriating a prairie dog's burrow, just as their relatives of the woodland will use an old flicker's hole or a crow's nest. The rattlesnake, too, will no doubt take refuge in a burrow of either of the others, though to the discomfiture of the rightful owner and the probable loss of its offspring. The stories of the peaceful cohabitation of the beast, bird, and reptile are, however, the result of a lively imagination.

II

BEAVERS

Family *Castoridae*

A wonderful, broad, flat, naked tail and webbed hind feet make these heavily built animals entirely adaptable to aquatic life. Both fore and hind feet are four toed, but the second toe of the hind foot is peculiar in having two claws. In structure of skeleton these largest of our gnawing animals agree with the squirrels and marmots in having the two bones which form the lower leg separate and not fused solidly together. The beaver is the water representative of the squirrel tribe as the muskrat is of the mouse family and the otter of the weasels.—(S. & C.)

Canadian Beaver

Castor canadensis (Kuhl)

Length—44 inches.—(S. & C.)

Description—Body thick and heavy closely covered with fur. Characteristic tail and feet, ears short. Dark bay or blackish brown, hairs tipped with chestnut becoming brighter on the head, sides of the neck, and rump; ears black, feet, legs, and under parts seal-brown. —(S. & C.)

Weight—A male beaver will weigh from 30 to 65 pounds.

Range—Northeastern North America, now nearly extinct within the United States.—(S. & C.)

The beaver, with races showing minor modifications, once inhabited all temperate America where there was wood and water. The entire beaver range was about six million miles and at as good a guess as may be made today the original beaver population was about 10,000,000 in years of abundance. In early days trappers sometimes took 500 animals in a year. The average annual total skins brought out by the great fur companies in the 'sixties and 'seventies when the fur trade was at its height was in round numbers 150,000. Natives doubtless killed many more both for food as well as pelts. The total destruction by man must have been in the neighborhood of 500,000 a year, to which must be added deaths from natural causes and from pestilence.

Nowadays the beaver, though very nearly extinct in the wild, is with suitable protection slowly coming back to his own. In the Yellowstone, in the Algonquin Park in Ontario, and now very slowly in the Adirondacks, beaver lodges and dams are coming again into existence. And best of all, both east and west, men seem fully awakened to the value and services of this peaceful, industrious fur-bearer.

Sluggish streams and small lakes with clay banks well-wooded with aspen and willow are eagerly sought for by beaver eyes. Streams that run in rock beds or are so shallow as to dry up in summer are unsuited to these gnawing animals: nor have they ever been found in large rockbound lakes.

Individual range is small. An unmated beaver, seeking a good location or a partner, may wander a dozen miles; but these preliminaries disposed of, he is not likely in future to travel more than a half mile from home.

The beaver dam is perhaps the most famous of animal undertakings. Everybody knows that it is the beavers' custom to dam up small streams and to build their thatched and mud-plastered log cabins on the margins of the ponds thus made. The dams ensure the makers sufficient depth to protect them from enemies over summer and sufficient to make certain that the water will not freeze to the bottom in winter.

The dam itself is a vast complicated structure of sticks, stones, roots, mud, and sod. Having selected the site, the beavers begin the work by cutting and laying quantities of brushwood lengthwise in the deepest part of the stream bed, butts against the current. Each stick, as it is laid in, is partly covered near the thick end with mud, stones, or clay. Night by night the beaver family labor until finally, by slow accretions, the wall is raised. Mud is obtained in the nearest place, just before the dam, so that in most cases the pond or small stream is deepest directly above the obstruction.

No dam is ever finished, no dam is ever without need of repair. Perpetual work by generations of beavers in time turns the stick dam into the bank dam, and the bank dam into a solid grass-grown mass of great resistance. Morgan in his standard work on "The American Beaver" describes dams that were 488 feet and 551 feet long. A dam mentioned by him as being 260 feet 10 inches long, 6 feet 2 inches high, 18 feet wide at the base, is estimated to have contained about 250 tons of material.

In addition to the dams the beaver constructs, when required, canals to transport the logs necessary for construction purposes and sometimes across necks and tongues of land to save long roundabout journeys. Famous canals

described by Morgan were 365 feet, 523 feet, and 579 feet long respectively. Several of these canals even have locks!

The beavers live in burrows or, when streams cannot be dammed, in bank dens, or in bank or island lodges. A typical lodge will be a rounded mass of sticks 20 feet across the base and 3 to 5 feet high cemented with mud except on the outside, which is covered with naked sticks. It will contain one circular chamber about 2 feet high and 6 feet across. There are usually two entrances: one abrupt, often winding, will be the ordinary runway; the other, quite straight, is for bringing in wood. The only air is what comes through the walls.

The cutting down of trees by beavers, though exaggerated stories tax the credence, is still on the whole one of the most remarkable of animal undertakings. Two beavers will cut down a three-inch sapling in as many minutes and a small tree in an hour or so. Morgan says: "When but two are engaged they work by turns, and alternately stand on the watch, as is the well-known practice of many animals while feeding or at work. When the tree begins to crackle, they desist from cutting, which they afterward continue with caution until it begins to fall, when they plunge into the pond, usually, and wait concealed for a time, as if afraid that the crashing noise of the tree-fall might attract some enemy to the place."

Beavers are also reported to have at times raised platforms of mud which enable them to reach higher and so cut through thinner growth. In cutting they gnaw deep parallel grooves round the trunk and then rip out the wood between these grooves in large chips, their broad teeth

splitting them out as does a carpenter's chisel. Some authorities claim that the beavers gnaw equally all round a tree and let it fall where it will; others are equally positive that they gnaw deepest toward the water in order that the tree may fall that way and lessen the work of hauling.—(S. & C.)

The making and repairing of the dam and lodge is not allowed to take up the entire time. Food must also be stored for winter. The beaver does not hibernate and must have supplies that he can reach by swimming about under the ice. Twigs are moored in the brushwood before the lodge, large sticks are sunk to the bottom of the stream. All winter the restless animals move about under the ice searching out roots and gnawing into bushes and trees along little brooks that wind back into the woods. When utilizing these hoards the frugal creature takes a piece into the lodge, eats the bark off, and then adds the stripped stick to the dam.

Beavers have many methods of communication. Young beavers wail like a crying child. Grown-ups hiss in menace or utter a querulous "churr." The splash signal plays an important part in beaver life. A beaver, discovering danger, gives a mighty slap of his tail before he dives. This is understood and immediately repeated to other beavers as they, too, disappear below the surface. Then there is also the castor, a yellowish smelly substance which is voided at will and serves as an important method of intercommunication though none too well understood.

The beaver is a strict monogamist. The mating season is February and the young are born in the month of May. They number two or five and after a month begin to take

solid nourishment. In another year they, too, will be old enough to mate and to provide for the further increase of the lodge. Beavers are thought to live from twelve to fifteen years and what little evidence there is points to the male as a model parent.

"As busy as a beaver" is a proverb of long standing, but it is a curious and a not entirely explained fact that there are beavers that will not work and are outcasts either from choice or necessity. These idlers never form dams and will only dig a hole from which they emerge to obtain food, returning to the same hole with the wood they procure. The industrious beavers try to deprive these idle fellows from enjoying the fruits of others' toil even to the extent of biting off their tails and otherwise maltreating them. These are always old males, and the most generally accepted theory is that they have fought and been conquered by others of their own sex, as the result of which they have been forced away from the lodges.

Enemies of the beaver in its heyday were the wolverine, the fisher, the bear, the wolf, and the lynx, while amongst swimmers the otter was quite willing at all times to vary his fish diet with a taste of beaver meat.

But the greatest of beaver enemies has undoubtedly been man that has desired him both for food and for clothing. The flesh is excellent and has served the Indians as their main sustenance over the vast extent of the Mackenzie Valley, as the buffalo did the Indians of the Plain States. The thick warm fur is one of the most highly prized of skins. Beaver fur was at one time extensively used in the manufacture of hats but has become so rare and valuable that it is now chiefly used for muffs, collars, and trimming. The early prosperity of New York

and Canada was based on the beaver the pursuit of which lured on the early explorers and brought here original colonists; and it was the beaver pelt that, bartered for the manufactured products of the old world, first made life tolerable for gentlefolk in the new.

III

RATS, MICE, AND LEMMINGS

Family *Muridae*

(S. & C.)

With few exceptions the members of this widely scattered family are popularly known as rats or mice, the difference having to do only with size. Their number and importance have caused them to be divided into three sub-families. They are mostly typical rodents in every respect.

I. Meadow Mice, Lemmings, and Muskrats. Sub-Family *Microtinae*
Thick-set, short-legged, short-eared, short-tailed (tail less than one third the length of head and body) (except muskrats), mainly burrowers.

II. American long-tailed Mice and Rats. Sub-Family *Cricetinae*
These are more slender, with longer legs and generally larger ears and eyes and long tail, the latter always more than half the length of the head and body, generally much more.

III. Introduced Mice and Rats. Sub-Family *Murinae*
Resembling in a general way *Cricetinae* but with different skull and teeth. Natives of the Old World who have followed man on his journey eastward.

I. House Mouse

Mus musculus (Linnæus)

(S. & C.)

Length—6.70 inches.

Description—General color gray, slightly tinted with yellowish brown, especially on the face and shoulders, dusky on the back; below paler gray sometimes suffused with buff.

Range—Cosmopolitan.

II. Norway Rat

Mus norvegicus (Erxleben)

(Also called *Common Rat, Brown Rat*)

(S. & C.)

Length—18 inches.

Description—Heavily built with thick head and moderate ears, tail medium, always shorter than the head and body. Yellowish brown thickly interspersed with long black hairs, grayer on the sides and grayish white below, feet whitish. Tail very sparsely haired with the scales very conspicuous, ears dull brown. Young dull gray with no brown tints.

Range—Cosmopolitan.

Mice are thought to have been originally natives of southern Asia who have followed man in his wanderings to all parts of the world. They have shown themselves strangely indifferent to changes of environment, specimens from widely separated latitudes having been found to be practically indistinguishable either as to form or color.

Being less exposed to weather and changes of temperature than are out-of-door creatures, mice are among the most prolific of animals, breeding unceasingly the year round. The period of gestation is little more than twenty-five days, and even with allowance made for losses caused by traps or their arch enemy, the cat, a pair of mice may easily become a thousand in the course of a year. At the start the young, which are born in litters of five or six, are hardly larger than blue-bottle flies, pink, wrinkled, almost transparent. Mice are notorious for their versatility in selecting their resting places, almost anything that has an entrance smaller than the cavity inside being utilized.

In most old houses there are mice living in the walls between the wainscoting and the plaster, their runways usually allowing them to make the complete circuit of the walls without difficulty. In cold weather they feed largely on flies, spiders, and the like, that have packed themselves thickly into cavities between boards and in warm garrets.

The Norway rat copies in a general way the proportions of a mouse, but the fur is apt to be harsh and lifeless, the eye dull and hateful. Rats infest boats, wharves, dark and neglected barns, and dwelling houses, eating food of almost every description and breeding with extreme rapidity. The old black rat (*mus rattus*) had a much better reputation than the more aggressive and troublesome Norwegian rat which has nearly everywhere driven out the earlier species.

Rats are carriers of the bubonic plague and probably other diseases as well. Though they perform some service as scavengers, this scarcely weighs in the balance in com-

parison with the harm they do. Scarcely any creature that lives and breathes is as universally detested as the common rat.

III. Grasshopper Mouse

Onychomys leucogaster (Wied)

(Also called *Scorpion Mouse*)

Length—6¼ inches.

Description—This genus comprises mice which have the general form of *Microtus* combined with the colors of *Peromyscus;* the soles of the feet are densely furred and have only four instead of six tubercles; the tail is less than half the length of the head and body. The front claws and feet are highly developed for digging. All above soft grayish brown sprinkled over with fine black hairs; on the sides and rump this shades into orange and buff and ends abruptly against the creamy white of all the under parts; the color is darkest on the lower back but there is no dorsal band as in *Peromyscus;* feet, white; tail, gray-brown above white below except on tip, which is all white. The whiskers and ring around eyes blackish. *The white of the cheeks meeting on the muzzle* is a marked color feature.

Six races are recognized, and the grasshopper mouse has been located all along the eastern edge of the plains from Texas to Manitoba. Dry sunny hillocks on the edge of thickets in open country are quite likely to have a full quota of these little animals, which in appearance are like a bob-tailed deer mouse or a white-footed meadow mouse.

There is a dearth of detailed information regarding the life and habits of this field mouse. Fore feet and claws clearly proclaim him a digger. It is quite likely that the grasshopper is strictly a ground and underground species, of nocturnal habit, unaccustomed and perhaps unable to climb. Apparently it frequents hillocks which it burrows quite thoroughly with its two-inch tunnels. Probably the species is non-hibernating.

Vernon Bailey, who kept a grasshopper mouse for some time in captivity, obtained much information regarding food habits. Chief and choicest food were crickets and grasshoppers for which the captive's appetite seemed insatiable. "On September 22nd in four hours it ate 30 large insects, chiefly grasshoppers and crickets; September 25th it ate 53 large insects as before in 12 hours, and apparently would have eaten more if it had had them. From this it will be seen that it is well worthy of the name grasshopper mouse." When very hungry the captive would eat seeds, grass, mice, frogs; ants were the only insects offered that appeared to be unacceptable.

Other observations made by Vernon Bailey were to the effect that the grasshopper mouse was quite likely to sleep all day if not disturbed and if not too hungry; that on waking up he was accustomed to gape and blink at the light some time before becoming fully awake; that he was liveliest in the early evening, seeming at times quite frantic in his efforts to get out of the cage.

The grasshopper mouse has been noted by several observers to have a prolonged, plaintive, squeaking call something like the cry of a flying squirrel.

IV. Arctic Deer Mouse, Prairie Deer Mouse

Peromyscus maniculatus arcticus (Mearns); *Peromyscus maniculatus bairdi* (Hoy and Kennicott)

(The Arctic Deer Mouse is also called *Tree Mouse, Wood Mouse;* the Prairie Deer Mouse is also called *Baird Mouse, White-footed Prairie Mouse*)

The genus *Peromyscus* comprises mice of about the size of a house mouse, but distinguished by the cheek pouches, peculiar upper molars, etc. They have large prominent eyes and ears, soft fur which is gray or brown above and white below; long tail usually bicolored.

Length—$7\frac{1}{4}$ inches (*arcticus*). $5\frac{1}{4}$ inches (*bairdi*).

Description—Arcticus. Above, grayish fawn color, clearest on cheeks and rump, with a broad band along spine from snout to hips of darker gray sprinkled with blackish hairs; under fur plumbeous. All below pure white; tail bicolored sharply, pure white below, brownish black above; a slight tuft on end.

Bairdi is smaller, much more slender and darker, having always a very dark or nearly black band down the back.

Another variety still, *nebrascensis*, is much paler than *arcticus*. The buff or yellow is very pure, especially on the hind quarters, and is greatly extended so that there is little or no dark dorsal band.

Range—Arcticus, western Canada, *bairdi*, Upper Mississippi Valley.

The deer mouse is much less abundant than its relative of the meadows. Locations near timber, settlers' houses and barns, unless perchance imported house mice have

arrived and driven the natives farther back, are all preferred nesting places. It is quite likely that every group of farm buildings in the province of Manitoba has perhaps a dozen pairs of deer mice as permanent residents.

They are expert climbers and locate most frequently in hollow limbs or in woodpeckers' holes high up in trees. The nest will be composed of straw, bark, and materials of like nature and, if necessary, may be roofed in and provided with a self-closing door. Most any cranny, high or low round buildings may contain a nest, which will always be found quite neat, warmly lined, and dainty. They probably do not nest in colonies, those being found in numbers being attracted together solely by prospects of abundant food supply.

One pair in a nest appears to be the rule. In many cases the male helps prepare the home and care for the young; but so many exceptions have been noted that it is not possible to say that this is the rule. The period of gestation is about twenty-five days and a pair may have four litters a season. The young are likely to be four or five in number, sometimes only three for a young mother.

The young are blind for about two weeks after birth. As soon as they are able to take care of themselves they leave the parental nest. Quite probably at the age of three or four months they themselves pair and reproduce.

With senses of smell, hearing, and touch as acute as they are, no doubt the species have means of intercommunication so slight in appearance as to escape the attention of humans. In this the well-marked livery and long tail no doubt play parts of some sort. Vocal power is

well developed, and many observers have thought that the mouse species communicate with their fellows by drumming with the feet.

This type of mouse is essentially a nut and seed eater; as also he does not hibernate, he must lay up a supply in the lush times of late summer and early autumn against the lean days of winter. Not far from his home den and, if possible, connected with it, will be found the storehouse, composed of as fine grain as can be obtainable and in good quantity.

Deer mice are nocturnal and are valid prey for owls, smaller weasels, short-tailed shrews, as well as some animals that move about by day as well as by night. Apparently flesh hunters keep the deer mice in good order, for they are never found in such numbers as to become a nuisance.

The prairie deer mouse (*bairdi*) partakes of many of the characteristics of its forest relative. Smaller, more slender, darker in color, this variety is essentially an animal of high, dry prairies. Never present in great numbers, the prairie deer mouse is seen most frequently near grain fields where it may be sure of a plentiful winter supply of stored food.

Underground homes are no more than an inch in diameter and of a depth of six inches below the surface, or, fully as frequently, the animal will nest in an overhanging bank or a bit of overturned sod. In cultivated fields the burrows are frequently dug at the roots of fruit trees.

This mouse is strictly nocturnal. The young, as with *arcticus*, are born in litters three or four times a year. Food is the various seeds of the prairies, insects, birds' eggs. Kennicott, who kept a pair of these mice with

their young in a cage, reports an astonishing instance of cannibalism, the general fact of which is confirmed from other sources.

V. Red-backed Mouse

Evotomys gapperi (Vigors)

(Also called *Red-backed Vole, Gapper Mouse, Wood Mouse, Long-eared Ground Mouse*)

The genus *Evotomys* comprises meadow mice much like those in the genus *Microtus* but readily distinguished by their large ears, long tails, and red back.

Length—5¾ inches.

Description—General color a buffy or pale ochraceous; the broad band along the back from crown to tail chestnut streaked with black hairs; under parts pale buff; feet gray; tail brownish above, gray buff below, tip black. In summer, darker. Usually the male has on each flank a gland marked by a pale patch of fur.

This species is dichromatic, appearing in two colorations, one the normal, above-mentioned, the other much grayer and the black stripe sooty instead of red.

Range—Alberta to Quebec and southward to the mountains of Pennsylvania and New Jersey.—(S. & C.)

The slender form, long tail, rufous-tipped ears, and bright colors make the Gapper mouse easily distinguishable from neighboring species. The typical form and six variations are recognized.

This is quite obviously a meadow mouse (*microtus*) that has taken to the woods and slowly adapted its color to

changed surroundings. This mouse is much less abundant than *microtus* and, since it is a woodland species, it is also decreasing with the clearing of the forests.

Mossy spruce woods seemed to E. A. Preble a favored haunt for the Gapper, but it is at times to be found living in any sort of timber, probably with home range extremely small. The nest may be in a superficial burrow, or hidden beneath logs, stumps, or moss.

The Gapper has many habits that set it apart from other ground mice. It does not seem to make the runways that are characteristic of meadow mice. It climbs about logs and old stumps with facility and has even been seen taking up its abode with civilized man as the meadow mouse never does.

And the species is probably diurnal. Merriam considers them both diurnal and nocturnal. "I have shot it at noonday scampering over the leaves in the deep woods and dodging in and out between the rocks of a lake shore. I have also seen it after dark in shanties and log houses and have caught many during the night in traps."

In food habits the Gapper is, as all other mice of whatever species, omnivorous, and like such mice as do not hibernate, it lays up a careful supply of roots, nuts, and seeds for winter consumption.

The red-backed mouse of southern New Jersey (*Evotomys gapperi rhoadsi*) inhabits exclusively the damp bogs that intersperse sandy pine barrens. Here it lives deep down in the sphagnum, which in winter must be frozen several inches below the surface. This mouse survives winter after winter presumably on such slender stores of vegetable matter as it has been able to hide away in its subterranean galleries.—(S. & C.)

VI. Meadow Mouse

Microtus pennsylvanicus (Ord)

(Also called *Field Mouse, Meadow Vole, Marsh Mouse*)

Length—6.50 inches.—(S. & C.)

Description—Body thick and compact, legs short, ears very short. Dark brown above with a general admixture of black hairs shading gradually into gray on the under surface. The color of the upper parts varies considerably, some individuals being decidedly blackish, others tinged with tawny, and occasional specimens quite chestnut with very few black hairs. The under surface also varies to dull buff.—(S. & C.)

Range—About 70 North American species and races of the genus *Microtus* appear in the latest lists. *Pennsylvanicus*, the type form, ranges from southern Canada to North Carolina westward to the edge of the Plains.

Meadow mice inhabit alike meadows and pasture land, orchards, gardens, and cornfields. They also show decided fondness for water and wet places. Along the edges of salt marshes they are quite likely to become semi-aquatic. When pursued here they often take to water; but their hopes are sometimes in vain for, though they may escape their enemies on land, pickerel are known to seize them from beneath the water.—(S. & C.)

The burrows are about an inch and a quarter in diameter, nearly round and continuous, zigzagging over the ground amongst the rank grass without plan or apparent ending. When these mice live in colonies, tunnels, runways, stores seem to be common property. The species is, therefore,

as far as we are in a position to judge, both sociable and gregarious.

This mouse also digs simple burrows hardly twelve inches deep having nests at the bottom where the young pass the first period of their lives, and from which in an incredibly short time they appear to survey the world.

Mating habits are unknown. Meadow mice are extremely prolific. A pair will probably produce six broods in the season between April and November and the number of young will be four to six in a brood. Some naturalists think the meadow mice breed all the year round, which will still further increase the totals. If it were not for the vigorous attentions of its numerous enemies this mouse would undoubtedly overrun the surface of the land within a very few years.

It appears probable that meadow mice live by preference on grasses of waste lands. Only when they are forced by over-population into fields of growing crops do they become a nuisance and a plague. As they do not hibernate, they collect with great diligence small stores for winter sustenance. This mouse has been known to tap squirrel stores and, while the squirrel is comfortably hibernating, to consume most if not all of the animal's spring supplies.

The enemies of this mouse are birds, beasts, even snakes. Among birds the Northern shrike or butcher-bird, lives almost entirely on meadow mice varying his diet with an occasional white-footed mouse *(bairdi)*. In central Illinois the Southern shrike has gained for itself by its prowess the name of mouse-bird. Kennicott describes the habits of the Northern shrike: "This bird takes his stand, day after day, upon the same tree or

fence-stake, and from this post surveys the surrounding fields in which no mouse may now show himself with safety. The result of the shrike's watchfulness and prowess may be seen, in part, in the bodies of the numerous mice fastened in the branches of bushes or on fences, sometimes partly eaten, sometimes having only the brains taken out, but oftener entire. The Southern shrike . . . not only pounces upon them when they are moving about, but finds the nests on the surface, and digs out the inmates with its bill and claws. A domesticated brown sandhill crane . . . became expert in finding them and when they were situated upon or near the surface he would dig them out with his long and powerful beak and after first killing all the inmates, proceed to swallow them whole with much apparent relish."

The short-eared owl, a diurnal prairie owl, lives chiefly on meadow mice. Hawks, from the great red-tailed buzzard to the little sparrow, prey on them. The prairie rattlesnake glides into their burrows for easy victims. Kennicott remarks: "In many specimens of this snake examined I have not found one the stomach of which did not contain the remains of meadow mice." Minks, skunks, weasels, foxes, prairie wolves, badgers, the domestic house cat when opportunity arises, all enjoy a meal of meadow mice. Indeed, the whole range of flesh-eating animals are far more dependent on the *Muridae* for sustenance than they are on the great ruminants. Without the mice carnivorous birds and beasts would speedily cease to exist.

VII. Muskrat

Fiber zibethicus (Linnaeus)

Length—24 inches.—(S. & C.)

Description—Body thick-set like a very large meadow mouse, legs short, tail scaly, nearly naked and flat. Fur thick with a woolly under fur. Dark above, somewhat tinged with fulvous, especially on the sides; beneath, dull white, with scattered fulvous hairs, white on the throat, with white lips and a brown spot on the chin.—(S. & C.)

Range—Eastern North America, southward to Virginia and the middle Mississippi Valley. Replaced in Labrador, Newfoundland, lower Mississippi Valley, and Dismal Swamp by closely related varieties.—(S. & C.)

The genus *Fiber*, of which the muskrat is the type, comprises animals which are anatomically merely immense meadow mice with naked tails flattened on the sides. The type *zibethicus* and six races are recognized.

Muskrats are to be found in marshy ponds and along the banks of sunny, slow-moving streams. Pine forests and dry open prairies are equally unacceptable. An isolated pond no more than fifty feet across will be sufficient, provided he may have it to himself, and a radius of two hundred yards will be as far as he will ever care to travel unless forced to go forth in search of a new home. I put the rat population of the well-watered province of Manitoba to be not less than 500,000 in years of fair abundance.

The muskrat is not as sociable as the beaver with which its method of life has much in common. They communicate among themselves by low squeaks and squeals and

they announce the discovery of danger to "whomsoever it may concern" by a loud alarm splash. They are also thought (though the evidence is none too strong) to have combined at times to resist a common enemy and to labor together in the building of their houses or rat lodges. The odor of musk from which the animal derives its name probably also serves to an as yet undetermined extent as a means of intercommunication.

The mating season is probably April and the species probably pairs: but of neither fact are we as yet entirely positive. The period of gestation is considered to be about thirty days. The litter numbers four to nine. The young muskrats are suckled for three weeks or a month. In some sections there are thought to be three litters a year, the first litter having young themselves by early autumn.

Except in size the nests of the muskrat are very similar to those of the beaver, and are among the most curious and interesting of this animal's doings. In July the advance of winter is forecasted in the work of the muskrat in repairing an old home or in erecting a new one. If a new nest is to be made, a place is selected where there is a foot or two of water amid reeds or rushes. To this spot are dragged vegetation and mud, gradually piling up a little island. By August the pile may have grown to be three or four feet high and taken on the outer appearance of a small haycock. But this haycock is provided with a spacious inner chamber and with several entrances and presently also with rafts.

Of these rafts—floating bunches of reeds anchored to growing vegetation—the animal is very fond. They serve a number of purposes. They furnish the family

with landing places where they may feed comfortably. In winter they serve as breathing places and as means to conceal movements to and fro.

The muskrats also at times make landing jetties which serve to deepen and clear the water and make possible a quicker jump to safety. At times in large ponds and swamps they make eating huts which enable them to extend their field of winter operations. Altogether, though without the great size and spectacular quality of the beaver's operations, muskrat work shows much intelligence along somewhat similar lines.

Muskrats do not apparently lay up a supply of winter twigs as do the beaver. They nose about for what can be found under the ice and, if supplies be scant, they have the resource of the sides of the rat house which are usually much thinner in spring than in fall.

So long as streams remain frozen the muskrat need have no worry over the dangers to which he is exposed in summer-time. There is generally a supply of air to be had beneath the ice close under the edge of the bank. The water flows on with the same gentle motion as in summer. Under the ice the temperature hardly varies a degree, whatever frost there may be above. While ice holds firm, Mr. Muskrat knows nothing of snow or sleet or biting winds. With streams kept full by melting snow and spring rains, the muskrats are somewhat restricted as to landing places, but as quickly as possible they seek out familiar tussocks, roots, and stones. In summer during the heat of the day they are often to be found swimming and floating about in the shadow of old willow trees where the water is deep and cool.—(S. & C.)

They have many enemies among which the worst is

perhaps the mink. The mink appear to feed regularly on muskrats, in the search for which they have many advantages, being able to follow their prey, however circuitous may be the underground trail that leads to the home nest. Hawks, owls, weasels, otters, foxes, wolves keep a vigilant and often successful eye on the young muskrats. Certain natural conditions work havoc among these water dwellers. If a severe winter follow a dry fall, ponds are quite likely to freeze to the bottom. The muskrat is then forced to the open or become sealed in, forced to prey on those of his own kind. Fortunately, such winters occur but rarely.

The flesh in the fall and winter is excellent, but in the spring and summer is too "musky," at least for the white palate. The fur is of good quality and in strong demand, being much dyed to imitate more expensive skins. As early as 1822 the Hudson's Bay Company exported 150,000 muskrat skins annually, and the number now is well up into the millions with ample supplies still existing.

IV

POCKET GOPHERS

Family *Geomyidae*

These little animals have large cheek pouches opening outside the mouth and modified fore feet with immense claws suitable for digging. The skull is thick, the body heavy, the movements clumsy. *Geomys*, the genus of gophers represented in the East, have grooved upper incisors. *Thomomys* is found west of the Mississippi Valley. *Tuza* is the Gulf Coast gopher. These animals are nocturnal and live in communities, burrowing in the ground like marmots.—(S. & C.)

Pocket Gopher

Thomomys talpoides (Richardson)

(Also called *Gray Gopher, Mole Gopher, Mole, Pocket Mouse, Gaufre*)

Length—9⅝ inches.

Description—Ears and eyes very small, front feet enormously developed for digging; tails very short, nearly naked, and developed as organs of touch used when running backward in the burrow; in each cheek is an enormous fur-lined pocket or pouch that opens in front outside of the mouth. Dark grayish, becoming browner on the back and pale slaty below; near white on chin, throat, feet, and tail. *Talpoides* is commonly

distinguished from its nearest neighbors by its greater size and darker colors.

Range—Two races are recognized, *talpoides* Richardson, the typical form, and *rufescens* Wied, redder in color. *Talpoides* is the most northward in range of the pocket gophers, being found in the western Canadian provinces and generally through northwestern United States (but not extensively on the Coast).

Pocket gophers find congenial surroundings on level prairies, low bottom lands, and sandy dunes. In general terms, throughout the region west of the Mississippi, wherever there is enough soil to burrow in and enough rain to grow green stuff, these gophers in one genus or another will be found. The actual number scattered over this very extensive area is excessively difficult to estimate. In Colorado, Wyoming, Dakota, Manitoba, there are considerable stretches of country where walking is laborious for man and quite difficult for beast owing to upheavals made by pocket gophers. I estimate the impressive total over the entire range of a billion gophers of which a hundred million may perhaps be *talpoides*.

Apparently, except in late spring at the time of mating, the animal is solitary. It is thought that there are five or six young in a litter and that by fall they are large enough to strike out and burrow for themselves.

The method of the gopher's burrowings has been observed with much care in captive specimens. Earth is loosened with the powerful front claws and thrust backward between the hind legs to be further passed on by the hind feet. When sufficient accumulation has been gathered, the gopher turns round and pushes the pile

ahead of him, usually out some side gallery. Burrows are about three inches wide and ramified indefinitely close to the surface. The burrower generally rests while the sun is high, but apparently digs steadily and pretty continuously at other times. Even a gopher must eat, and in twilight or by the light of the moon he sallies forth in search of grains and of green vegetation. Food is hastily crammed into his capacious cheek pouches to be consumed on return below ground. The pouches seem used solely for the storage of food and rarely, if ever, in the process of removing excavations, as was thought by the travellers who first observed the animal.

Food is probably exclusively vegetable: roots of various sorts gathered underground, grasses and grains above. Foods are also stored for the winter usually in blind alleys off the main runway.

The burrows of this persistent digger are for two purposes, forage and residential. Forage burrows are likely to be two to three inches in diameter and four to eight inches below the surface. Details of a burrow excavated at Pagoda Peak, Colorado, in 1901, are as follows: The burrow was on a slope with an eastern exposure; 125 feet was dug out, most of it at about 4 inches below the surface, but dipping vertically down through hard-pan 24 inches near the nest; the central chamber was 12 inches long, 9 wide, 7 high, with a 3-inch lining of finely chewed grass and quite clean.

The gopher, in company with other animals that make elaborate homes, has progressed well in sanitation. Special places or pockets were provided for dung in this burrow and are thought to be habitual with the animal.

Pocket gophers are believed at times to have dug down

spirally as much as 15 feet, but a typical tunnel will be quite near the surface (4 to 10 inches down and about 3 inches wide). Tunnels are connected by frequent side galleries with the surface, though sometimes they run for unaccountable distances without such connection.

Curiously, these rodents are sometimes provided with a companion, or parasite, for the winter in the person of amphibians of the genus *Ambystoma* who quite frequently take up residence in their burrows. The common toad is accustomed to take advantage of the loose gopher mound when the time comes to dig in for cold weather.

A common habit of various races of pocket gophers seems to be that of leaving the burrow open an hour or two toward noon on sunny mornings, presumably for air or for sunlight. They seem not to hibernate, apparently continuing their labors below ground through the coldest of weather. In the spring after snow and ice have disappeared many tunnel plugs of gophers are to be found in curious serpentine labyrinths over the grass of the hollows.

Night-roaming animals of all sorts, particularly owls, but also hawks, badgers, weasels, coyotes, and foxes, cause some check on the gopher population. Snakes are known to enter the tunnels if perchance they discover them open.

The gopher becomes very suspicious of an opened tunnel: if he finds his tunnel open several times in succession, he is quite likely to abandon operations. I have seen patches of fifty to a hundred yards on a damp creek bottom with plenty of old but no recent signs of gopher work, and conjecture that the gophers must have been exterminated by weasels.

The fact of the absence of earthworms from the virgin prairies of the Northwest is well authenticated and it is possible that the pocket gopher may have filled the same rôle as Darwin attributes generally to the earthworm in the making of the rich layer of vegetable loam with which the prairies are covered. The black loam of Manitoba is a foot or even at times two feet thick, not a solid bed of decayed matter but thoroughly mixed with the upper formation.

Darwin reckoned that the earthworms in five years bring up enough soil to cover the ground an inch thick, and that, therefore, the labors of this insignificant little creature assume a rôle of vast importance. It seems probable that the pocket gopher will accomplish the same result in a period of no more than five months. The gopher's method—if not as effective as that of the earthworm—answers the purpose of fully disintegrating and mixing the dead vegetation with the soil to produce a rich and fertile black loam. It must also be remembered that the gophers are more or less active the year round, and with the greatest possible allowances for periods of comparative inactivity and for sparsely populated regions, we get a minimum upheaval of between two and three inches per annum. The aggregate power of this continental army of rodents in tilling and draining the soil is scarcely understood, and in addition they undoubtedly contribute to wide geological changes by the vast quantities of soil they bring under the influence of sun and wind. So, small and insignificant as he is, the world must reckon with the pocket gopher!

V

JUMPING MICE

Family *Zapodidae*

Jumping mice differ in many respects from true mice and are to be recognized at once by their extremely long hind legs and tail and by the coarseness of their fur. In their jumping habits and long legs they resemble the jerboas of the old world and the kangaroo rats of our southwestern states. Of the two species in this country the meadow jumping mouse is better known than the large woodland jumping mouse, easily identified by its white-tipped tail.—(S. & C.)

Jumping Mouse

Zapus hudsonius (Zimmerman)

(Also called *Meadow Jumping Mouse*)

Length—8.80 inches.—(S. & C.)

Description—General color yellowish fawn to rather dark ochraceous mixed with black-tipped hairs which predominate on the back making it much darker than the sides; belly white, somewhat suffused with buff; feet white; tail white beneath brownish above, 130 mm. long. In autumn fur is yellower and less dusky above. —(S. & C.)

Range—With slight variations from Hudson Bay to North Carolina.—(S. & C.)

The typical jumping mouse is commonly found in thickets, around ponds and lakes, and about the edges of woods. The prairie jumping mouse is really more an animal of the prairie borderlands than of the prairie itself. The home range is doubtless greater than that of the meadow mice. Jumping mice seem to be found in fair numbers in parts of the country suited for their life and development, but are scarcely ever to be found in abundance, as naturalists commonly apply the word. They seem to be solitary, associating together only at the time of mating, which is fixed, but with no great certainty, for the fall.

Notwithstanding its reversal of true digger type in which the fore paws are strongest, the jumping mouse is a burrower, living in short burrows in the summer, in deeper burrows during fall and winter. Audubon and Bachman note that when captives were provided with a foot of earth at the bottom of the cage they quickly formed a burrow with two outlets. In the woods they often make a nest inside of hollow trees and in summer under meadow clods that have been turned up early in the spring and have convenient hollow spaces beneath.

The mother carries the young attached to her teats, a habit well developed in most of the mice but rather incongruous in an animal taking the flying leaps that the *Zapus* does. Audubon and Bachman early remarked and later observers have corroborated the fact that this is done not deliberately and leisurely, but only when the mother is alarmed while giving suck. She dashes forth instinctively and they hold on instinctively, though not very effectually for any length of time. Much popular error has grown about this fact, however, people assuming

that the young became attached to the teats after the manner of the young opossum and were incapable of relaxing their hold.

Food consists commonly of vegetable growths, buds, leaves, bark, seeds of grains, nuts when obtainable. Audubon and Bachman noticed that the storage habit was well developed in their captive *Zapus*, who labored diligently to store away in burrows the wheat, maze, and buckwheat on which they were fed.

Enemies are every sanguinary flesh eater that roams the fields, but the *Zapus* with its leaps, which it takes only when life is endangered, manages to outdistance at least the first pursuer of which it may catch sight. The *Zapus* is estimated to be able to leap forty times the length of its body, which in a deer would mean clearing one hundred yards at every bound. Audubon and Bachman "doubt whether there is any quadruped in the world of its size that can make its way over the ground as rapidly, or that can in an open space so quickly evade the grasp of its pursuers."

The extraordinary tail plays a part in these big leaps. Deprived of this rudder and balance the animal would either jump very weakly or with bad aim that would make the jump of no avail. A strange incident is reported by G. S. Miller, Jr., of a jumping mouse deprived of its tail. "But the animal had lost all control of its movements. When I approached it made violent efforts to escape, but the moment it was launched in the air, its body, deprived of its balancing power, turned end over end, so that it was as likely as not to strike the ground facing the direction from which it had come. The next frantic leap would then carry it back to the starting point."

Many observers have thought that the *Zapus* jumps from its hind feet unaided by its fore feet or tail, and lands on all fours as well as tail; but the motion is so quick as to defy close examination even by trained eyes.

Some conflict of opinion exists as to whether the jumping mouse is strictly nocturnal in its habits. Probabilities appear to be that it is crepuscular, being able to and occasionally travelling at all hours of the day and night, but being by preference a lover of soft twilight.

The jumping mouse vies with the black bear, the coon, the skunk, the woodchuck, the chipmunk, and the bat, for the title of deepest of winter sleepers. The animal prepares a deep burrow late in August, well lined, below the reach of frost and within easy reach of stored food. To this nest he retires in early September in most of Canada; later farther south. Nearly all animals found in a state of hibernation have been solitary.

Torpor is most profound. The animal has been turned up accidentally from the ground and we have notes of naturalists who have observed it in a state of captivity. Torpor of animals seems largely controlled by temperature, but certain races appear to have a strong constitutional tendency to torpify at a given time without much regard to cause. The jumping mouse in torpor is thought at first sight to be dead; it lies coiled into a tight ball, its head commonly between its legs and with feet closely applied to the head; respiration exists but can be perceived only with difficulty. When brought into a warm room in such a condition the animal very slowly revives, respiration becomes more vigorous; presently the limbs straighten out, and at last the jumping mouse leaps about as in normal life.

Zapus is commonly, also, a late riser in the spring, being often turned up, still torpid, by the spade of the gardener in late April and May. Yet, like the chipmunk, warm midwinter spells seem occasionally to bring it up to the surface.

VI

PORCUPINE

Family *Erethizontidae*

The porcupine, more interesting as a species than as an individual, is a significant example of the beneficent protection rendered to every creature according to its needs. Wherever found, porcupines may always be known by their spines. Short legs, plantigrade feet, and short thick tail are also characteristic. The quills are scattered amongst the hair and all point backward. They may be elevated at will by muscular contraction of the skin and are so loosely attached at the base that they are frequently impaled in the face or feet of animals that come in contact with them. The porcupine family have many wide variations of form in different parts of the world.—(S. & C.)

Canada Porcupine

Erethizon dorsatus (Linnaeus)

Length—28 inches.—(S. & C.)

Description—Dark brown to nearly black, quills tipped with yellowish, two and four inches long, mostly concealed by the hair which reaches a length of six inches; toes, four on the front feet and five on the hind. —(S. & C.)

Weight—Well-conditioned adults average 15 to 20 pounds in weight.

Range—Northern parts of North America south to Maine and in the higher mountains of Pennsylvania. Not found south of the Canadian faunal zone.—(S. & C.)

The individual range of this slow-moving creature is very small, perhaps no more than a couple of acres of ground through a period of years. Instances are known of Indians having located a porcupine, waiting a week or ten days till the animal was wanted for food before going in search of him, being confident that he would be found at only a little distance from where first located.

Thick hemlock or jack pine are the creature's haunts. With food supply far in excess of demands migratory impulses are unknown. Entirely unsociable and non-gregarious, this quilled animal is among the most solitary of quadrupeds. About the only time numbers of "Porkies" are to be seen together is occasionally about lumber camps; but for this there is a special reason, the animal passionately craving salt and gnawing to pulp any bit of wood that tastes the least bit briny.

With constant food supply also, the porcupine has no need to hibernate over the season when most green things are non-existent. The nest will be in a hollow tree or log, a cave, or maybe a hole under roots of trees. In cold rough weather he stays here day and night curled up with his back to the entrance, endeavoring to sleep and to forget his hunger. As soon as milder weather is scented, he crawls forth and makes haste to stuff himself with bark and green twigs. Of the mating habits of these secretive denizens of the wood very little is known. The young are thought to be born in late May and to be capable of taking care of themselves by August.

"The slowest, stupidest thing" in the woods is the porcupine. He will waddle into almost any kind of danger and eat anything his jaws may reach. In a tree he moves about with the speed of a sloth. In the water he floats because of his quills and manages to paddle at times a quite considerable distance.

In cold weather his diet is the bark and twigs of hemlock preferably, but also aspen, jack pine, elm, cottonwood, or probably whatever trees are easy of reach. He carefully distributes his weight, bringing several branches together and bending back their ends. Finding a tree to his liking he may remain in the branches day and night until there be scarcely a bit of foliage undisposed of. Merriam reports having seen hemlocks completely stripped by porcupines, "not a green twig remaining even on the smallest bough."

In summer food appears to be more varied. The fondness of the animal for lily pads has been mentioned by many observers. Doubtless other aquatic plants, reeds, and grasses are as eagerly sought.

The quills are about an inch long on the head, four inches on the back, so hidden in the wool and hair that they are difficult to see, so thickly placed that many remain even after the body is partly decomposed. There are no quills on the muzzle, under parts, or legs. When the porcupine meets an enemy from which escape is impossible, he tucks his head under cover, raises his quills, and lashes his tail vigorously. If he has no cover for his head, he backs in whatever direction it seems to him best to go, lashing the tail to clear the path.

With these quills "Porky" is almost always a victor. Among animals only the fisher or pekan has learned with

an insidious quick paw to upset the clumsy animal, ripping open its stomach before the upright position in which alone the quills are effective can be regained.

Bachman gives an interesting and typical description of the encounter of a porcupine with a mastiff: "The dog seemed regardless of all its threats and probably supposing it to be an animal not more formidable than a cat, sprang upon it with open mouth. The porcupine seemed to swell up in an instant to nearly double its size, and as the dog pounced upon it, it dealt him such a sidewise lateral blow with its tail as caused the mastiff to relinquish his hold instantly and set up a loud howl in an agony of pain. His mouth, tongue, and nose were full of porcupine quills. . . . Although the servants immediately extracted the spines from the mouth of the dog, we observed that his head was terribly swelled for several weeks afterward and it was two months before he finally recovered."

Yet certain natural causes have at all times tended to keep the number of porcupines within reasonable bounds. From forest fires he is too slow to escape. He seems particularly susceptible to foes within himself: most adults seem infected more or less seriously with tapeworms. The fisher has learned the trick of attacking the knight of many spears on his Achilles heel. And man, white and red, has slain him wherever found. The red man desired him for food; the white killed him because he destroyed dogs and made a nuisance of himself round lumber camps.

The secret of the porcupine's existence, his claim to fame, is his quill equipment, and by the great law of compensation, to get his quills he was forced to relinquish speed, cunning, even sharpness of eye and ear. Yet in a

general way the results have justified the sacrifices made. Among the flesh eaters of the woods there are probably none who have not, with results disastrous to their own lives, been foiled of their intention to procure a meal of "Porky." Not till the advent of an upright creature with shotgun or rifle did the porcupine meet a foe with whom he could not cope and before whom he went down in great numbers to destruction.

VII

RABBITS AND HARES

Family *Leporidae*

The family *Leporidae* comprises large, terrestrial rodents which have soft, dense fur, very long ears, long hind legs, short bushy tail, and a remarkable duplication of the upper incisors, a rudimentary pair behind the usual two in front of the upper jaw.

I. Snowshoe Rabbit

Lepus americanus (Erxleben)

(Also called *White Rabbit, White Hare, Northern* or *Varying Hare*)

Length—18 inches.

Description—In summer the typical varying hare about Hudson Bay is of a reddish brown above more or less peppered with black tips to the hairs, especially on the back; becoming clear pale sienna on the legs and pure white below; the upper part of the tail is very dark gray, almost black; the under part white; the ears are tipped with black behind and bordered with white in front. In winter it is pure white with tinges of brown below the surface and with the black ear tips unchanged.

Range—Wooded regions of northeastern North America

southward along the Alleghanies to West Virginia, becoming scarce south of Maine (*virginianus*).—(S. & C.) Other forms stretch across the continent and up to Alaska and the Hudson Bay region. In all, the type and eleven variations (with minor changes of color too numerous to detail) are recognized.

The white season of the snowshoe rabbit is from mid-October to mid-April; the other six months the name is quite inappropriate, for the snowshoe rabbit is brown. These variations, which puzzled early naturalists, are not due to an actual change in color, but to a moult. The brown coat of summer is succeeded by the white coat of autumn; this in turn the following spring is succeeded by a new brown coat.

Of all our wild animals rabbits are beyond question the most helpless and incapable. It is impossible for them to use their paws for grasping as most of the quadrupeds do; nor have they elaborate mouth pouches in which to store food. Winter and summer their shelter must be the drooping boughs of low trees beneath which they crouch for protection against the storm and concealment from enemies. The young rabbits are from the first provided with little more shelter than the leaves above them and evidently must be left quite unprotected when the mother goes away in search of food. As soon as they are able to take care of themselves the youngsters are turned out into a world which at this time of the year offers both food and enemies in plenty.—(S. & C.)

The young are usually two, occasionally three in number, produced after a period of gestation of probably thirty days. Bachman declares from observations on

rabbits bred in captivity that young ones leave the nest in ten or twelve days and from that time provide for themselves, receiving little protection or sustenance from their mothers. The young are usually full grown by autumn but do not breed until the following spring.

The rabbit population of a given area in the Northwest varies greatly from causes that have never received adequate explanation. A wave of fecundity seems to sweep the rabbit race; the numbers increase enormously, then plague appears and the animals die by thousands. I have seen rabbits in sufficient numbers in the province of Manitoba to be estimated at 10,000 to the square mile.

The snowshoe rabbit is an animal of thick cover. Dry copses varied with open glades and willow thickets so dense that enemies have no chance in open chase are ideal. Cedar swamps, if not actually wet, will do. The only place where the snowshoe rabbit cannot be found will be big timber.

The circle that the hare makes when pursued by the hound is thought to be merely a circle round the home range. This varies with the character of the country and may perhaps be twenty or thirty acres in thick territory; and twice as much in territory more open. Yet individuals are thought to have passed their lives within even smaller radius, perhaps no more than 200 yards, beyond which they would not venture unless hard pressed.

Evidence is conflicting as to whether hares are in any way sociable. It is commonly held that they come together only when their numbers are so great that it cannot be avoided. They notify each other of danger in their efforts to get away from enemies, but it is not thought that such information is more than casually conveyed or

represents any care of the individual for the life of its fellows. Charles G. D. Roberts states that in New Brunswick he has frequently seen a half-dozen hares gathered together as by appointment. They would chase each other about in some open space and through adjoining woods apparently in games of some sort. Social gatherings of hares have been occasionally reported by other commentators.

Of all our common rodents rabbits are least given to flesh eating, though it has unfortunately been proved that they will occasionally indulge in it, selecting that which is nearest to them, their own young. Summer food is grass, clover, green shoots of all sorts. Winter diet will be dead grass, buds, and the tender bark of willow and like trees.

When the buds of the gray birch begin to swell in late winter the hares in many sections seem to prefer them to other food and often wander considerable distance in search of young growth. Small stalks they will cut off close to the ground to get at buds and twigs beyond their reach. But they never carry food with them to their evergreen retreats, so they are forced to be abroad in all sorts of weathers.—(S. & C.)

The rodents are not high in the scale of animal intelligence and even among its own class the rabbits stand rather low. Speed and fecundity are what keep the rabbit race alive.

Their lives run about the same in winter as in summer. The principal changes are in coat and diet. Rabbits usually pass the day crouching motionless, half in the shadow. Toward sunset they start out in search of food and, especially if there be moonlight, are abroad most of

the night; they are also found quite frequently, especially toward the end of winter, sunning themselves at midday in some high spot.—(S. & C.)

As has been stated, the snowshoe's safety is its speed. Careful estimates show that the rabbit can clear eight or ten feet at a bound and make four bounds a second, which is at the rate of more than twenty-six miles an hour. It can get up top speed on the instant, can dodge with adroitness. And its light feet (approximately three pounds) enable it to skim on the surface of deep soft snow to the despair of its pursuers.

Like the jack rabbit, the snowshoe will sometimes make an observation hop or high leap as it runs; but obviously the act is less valuable with him than with his relative of the prairies.

The enemies of the hare are first himself and then every predacious beast, bird, reptile, and fish! Rabbits more than other animals seem to be susceptible to plagues and to interior disorders, parasites, tapeworms, etc. In the undergrowth the animal is safe from the open attack of fox, lynx, hawk, and owl. Curiously enough, it sometimes loses to a combination of different species. A hawk or owl will circle about while the fox ferrets out the quarry. Reynard himself is always on the watch, hoping that the rabbit, pursued by other enemies, may jump his way.

Snowshoe rabbits have at all times been used for food by red men and white. Reference has been made to the diseases to which the animal is subject; but if healthy-appearing specimens are selected, proper cooking should dispose of the dangers of micro-organisms. Though the fur is commonly too thin and brittle for commercial use the Indians found the skins handy for many purposes.

Particularly, strips were cut and pleated into warm blankets that have protected many a prospector and traveller from the rigors of northern winters.

II. Cottontail

Lepus floridanus mallurus (Thomas)

(Also called *Rabbit, Gray Rabbit*)

(S. & C.)

Length—17 inches.

Description—Above, a fine mixture of brown, cinnamon, and russet, grayer on the rump, dusky edgings to the ears and an indistinct dusty spot between them; below, white with a brown band across the breast; lower surface of the tail pure white.

Range—Lowlands of the Southern and Middle States from northern Florida to the Hudson Valley in the East and to West Virginia and Tennessee west of the Alleghanies. Other closely related varieties replace this form to the North and South and many allied species occur in the West.

The southern rabbit prefers briar-grown berry patches, underbrush, and young growth amid the fallen giants and rotting tree stumps; in default of such choice locations they may be found in any sort of woods or often established in isolated clumps of bushes no more than a few yards in extent.

Like the white rabbit the cottontail has well-beaten paths which it follows winter and summer alike. The cottontail is much more likely to live in a burrow than the more northern species. This custom, particularly as

often he does not provide himself with more than one exit, frequently does him more harm than good. The mink, the skunk, and the weasel can all enter into any aperture that will admit a cottontail and many vacant burrows must testify to their success.

The food of the gray rabbit seems to be of much the same general character as that of the white, but undoubtedly more varied, including fruit and often garden vegetables when available. Like all rabbits the cottontail often crouches motionless, with an intention of escaping notice in which he is usually successful. Except for the slight agitation of the whiskers and the motion of breathing, he is lifeless; but just as you seem almost upon him he slips from your hands and races away. The young cottontails imitate their elders and often may be seen in late summer with large black eyes and serious expression sitting beneath the ferns and brambles.

There are four separate races recognized by naturalists.

III. Prairie Hare

Lepus campestris (Bachman)

(Called also *Jack Rabbit, Prairie Hare, Jackass Hare, White-tailed Jack Rabbit*)

Length—25 inches.—(S. & C.)

Description—Larger than any of the preceding, with very long hind legs and ears, color above yellowish gray, sides and back of neck lighter, below white, tail entirely white. Turns pure white in winter in the northern part of its range; in the southern part the change is partial or possibly non-existent.—(S. & C.)

Range—From western Minnesota and Iowa to the Sierra

Nevada Mountains and from central Kansas and Colorado to Saskatchewan and Manitoba. Represented southward and westward by a group of allied species known as black-tailed jack rabbits.—(S. & C.)

The prairie hare is easily to be distinguished from other species by its size and more particularly by its brushy tail of pure white. In times of sudden flight this is not held against the back like that of a cottontail, or snowshoe, but straight out behind, or switched from side to side like the white flag of a white-tailed deer.

This, the largest of our hares, has a wide distribution on prairies, plains, mountains, and in the forests of the Northwest. The typical form and two variations are recognized.

The scattering low cover of the prairie is its favorite home and the hare is one of the few wild animals still willing to linger on ploughed surfaces. The individual range of the jack rabbit is probably not more than two miles. When pursued, a hare will run about in a circle often less than a mile from a central point; and location being once discovered he can usually be turned up somewhere in the near vicinity.

The prairie hare is a solitary, seldom associating with its fellows except at the time of mating. Lewis and Clark recorded more than a hundred years ago that these hares "are generally found separate and are never seen to associate in greater numbers than two and three."

Home is only an open "form," a little space trampled flat amid weeds and bushes. Here it sleeps in all weathers, always alert, always ready to dash away on the first hint

of danger. Living entirely in the open, jacks are necessarily dependent upon the speed and delicacy of hearing characteristic of the species.

Doctor Coues well says: "The first sign one has usually of a hare that has squatted low in hopes of concealment . . . is a great bound into the air with lengthened body and erect ears. The instant it touches the ground it is up again, it does not come fairly down and gather itself for the next spring, but seems to hold its legs stiffly extended, touch only its toes, and rebound by the force of its impact. As it gains on its pursuers and its fears subside, the springs grow weaker and finally the animal squats in its tracks on its haunches with a jerk, to look and listen. One fore foot is advanced a little before the other, and the ears are held pointing, in opposite directions. The attitude at such times is highly characteristic."—(S. & C.)

The young are brought forth in the "form" after a period of gestation of thirty days. The youngsters are born well furred, with eyes open; by the end of a week they are active and move about; and in no more than a couple of months they often start forth to shift for themselves. They breed rapidly with several litters a season. In natural surroundings numbers are apparently held in check as much by the scarcity of food as by the assaults of their enemies. Supplied with plentiful fodder they increase enormously despite the farmer's efforts to protect his crops. Epidemics reduce their numbers, but a few seasons are usually all that is needed to reëstablish them in abundance.

Jacks feed on buffalo grass and weeds, leaves of low bushes, practically all things vegetable. On cultivated

land they seem equally pleased with grains or garden truck or the bark of young orchard trees.

The hare is low in mentality, which, indeed, with his excessive speed, he scarcely needs to develop. I consider him the speediest wild four-foot left in the Manitoba prairies to-day, putting him second only to the antelope. The hare is faster than dog, coyote, or fox, and can often outrun the greyhounds in open chase. Many observations tend to the conclusion that it can travel for a mile or more at the rate of nearly thirty miles an hour. Captain Lewis measured the leaps of a prairie hare and found them commonly eighteen to twenty-one feet.

The eagle, the red-tailed hawk, the prairie falcon, all occasionally kill jack rabbits, but their most destructive foes among the kindred of the wild are wolves and foxes. The coyote is particularly successful as a hunter, and in regions where the coyotes have been killed off the jacks have immediately multiplied to be even a greater nuisance than were the coyotes before them.—(S. & C.)

And as usual amongst the important enemies we must include man. During the autumn and winter rabbit country is searched persistently by men and dogs. Formerly in sections where they were plentiful, drives were organized and areas several miles in extent would be beaten over by men on horseback who closed in, as they advanced, driving the game before them toward some enclosure from which there would be no escape. Jacks are fully as swift and resourceful in dodging the hounds as are the hares of the Old World and may be hunted with greyhounds as they are abroad.

Not much can be said of the usefulness to man of these creatures, but as to their beauty there can be no argument.

The hare is an exquisitely beautiful creature, an ornament to the plains, a delight to behold. I would preserve it, and a hundred others, even as I would preserve a beautiful picture or view, for the unsordid joy of feasting the eyes on a sentient fellow creature that is a little pinnacle on the cathedral of evolution, and glorious as an exemplar of beauty in the wild way of life.

PART III

CARNIVORA

(FLESH-EATERS)

CARNIVORA

(FLESH-EATERS)

(S. & C.)

Next to the rodents the animals of the order CARNIVORA are probably the most numerous, being occurrent in all parts of the world except Australia. These typical flesh eaters are mostly strong, agile, ferocious, living on smaller animals which they kill themselves.

They are to be divided into two sub-orders, seals adapted to an aquatic life (*Pinnipedia*) and terrestrial carnivora (*Fissipedia*). Skull and teeth provide distinguishing characteristics. In the CARNIVORA the canine teeth are very large, the molars are tuberculate, generally more or less sharp and pointed, suited for cutting and tearing flesh. The feet are moderate, never elongated as in the hoofed animals, and are provided with sharp claws. They are plantigrade or digitigrade, according to whether the whole foot touches the ground when walking as in the bears, or only the tips of the toes as in the cats.

I

EARED SEALS

Family *Otariidae*

The eared seals have external ears and mostly soft fur under their long hair. The fur seal of Alaska is the best known representative; the hair seal and the sea lion also belong to this family, which is to be found in North America only on the Pacific Coast.—(S. & C.)

Fur Seal

Otoes alascanus (Jordan & Clark)

(Also called *Sea Bear*)

Length—6 feet. (Female, 3 feet 10 inches.)—(S. & C.)

Description—Body covered with a very fine soft under fur and a coarser, longer growth of hair overlying it; color chestnut brown to black, in old individuals strongly mixed with gray, especially above.—(S. & C.)

Range—Pribilof Islands, Bering Sea in the breeding season, at other times all along the coast of California. —(S. & C.)

There are three recognizable species of fur seals, of which the Alaskan fur seal is the most numerous and the only species that may be called strictly American. Other species of fewer numbers inhabit Bering and Medni islands, also Robben Island in the sea of Okhotsk.

The fur seal is migratory. Summer and autumn are spent in the breeding grounds on the Pribilof Islands. The rest of the year is spent at sea, the range extending down the coast as far as the limits of Southern California. Governmental investigations and numerous reports have caused us eventually to have more detailed information regarding the fur seal than we have regarding any other wild animal.

The United States, after it came into possession of Alaska, regulated with great care the killing of seals on these barren islands. No nation has jurisdiction over the water more than three miles off shore. Poachers, of which there were more and more as the demand for sealskins increased, killed extensively outside the sea limit, doing double damage; for the only seals which put to sea at this season are the mothers with baby seals left on shore which inevitably die. Before the matter could be adjusted by agreement of the nations, such inroads had been made on the number of seals as to bring the race almost to extinction. In 1911 the United States, Great Britain, Japan, and Russia, constituting the North Pacific sealing convention, agreed to prohibit pelagic sealing in the North Pacific north of 30° L. for a period of fifteen years.

Female seals reach maturity at the end of two years, the males not until seven years old. Sealers call the young males of three years the "bachelors" and those a little older the "half-bulls." These young males herd by themselves and their destruction by sealers causes no serious harm to the herd.—(S. & C.)

The summer life of the rookeries follows an established course year after year. Early in spring the old bulls begin to arrive and to select positions for themselves on

the rocky beaches. These they are prepared to hold against all comers, and to hold them they are forced to fast the entire two months odd of the breeding season. When about the middle of July they put to sea again, their thick coat of blubber has been mostly absorbed as nourishment and they look thin and exhausted.—(S. & C.)

The young bulls and bachelors commonly make no efforts to intrude upon the preserves of the old bulls, but old bulls who for one reason or another are late in arriving, or in securing position, raid adjoining "harems" and steal cows, producing great disturbance and fights which often result in the death of one or both combatants.—(S. & C.)

The single young seal is born shortly after the arrival of the female. As soon as it has acquired a little strength, she leaves it periodically, pushing out to deep sea to feed. The little seals are left in one great group, but the mother on her return after a week's absence has no difficulty in recognizing her offspring; she is said never to err in picking out her own cub, now clamorous for food.

Sealers kill the young males by clubbing them on land. The skins are salted and packed; later the coarse gray hair is removed and the skin is carefully dyed by repeated treating with a brush; thus a long process must be gone through before the rough hairy pelts are ready for Milady's attention.

The herd remain in the rookery till the approach of severe winter weather. Toward the end of the stay discipline is relaxed, the old bulls no longer terrorize the cows and young bulls. Presently there comes a day when the animal instinct says "Go!" and the seals put forth to sea! For the winter months they remain scattered, some doubtless never leaving the icy Alaskan seas, others voyag-

ing down to the warm waters of Southern California. However far they wander, spring will find them heading toward the desolate Pribilof Islands again.

Besides the fur seals this group contains also the sea lion (*Eumetopias stelleri*), known as Steller's sea lion, and the much more slender Gillespie's seal (*Zalophus californianus*). The seals seen in Zoölogical Gardens and circuses are usually Gillespie's seal. Sea lions do not have the soft underfur that makes the fur seal so valuable commercially.

II

SEALS

Family *Phocidae*

(S. & C.)

Seals are carnivorous animals modified for life in the water. Bodies are cylindrical; limbs short with the feet flattened and webbed for swimming, the forward pair acting as paddles, the hind feet as a propeller; the hind feet are placed close together and are permanently directed backward. Seals have no external ears.

The presence of hind feet and the absence of broad fish-like tails distinguish seals from the whales with which, nevertheless, they are often popularly confused. Seals, while most at home in the water, come regularly on shore at the breeding season and occasionally at other times.

Seals occur in all oceans, but are most plentiful toward the poles.

Harbor Seal

Phoca vitulina (Linnaeus)

(Also called *Common Seal*)

(S. & C.)

Length—4 feet.

Description—Coloration variable; generally yellowish gray above, irregularly spotted with black, beneath

yellowish white with small black spots. Often dark brown everywhere varied with light spots. First toe never longer than the second.

Range—North Atlantic south to New Jersey, replaced on the Pacific by the closely allied Pallas' seal (*Phoca largha* Pallas).

The harbor seal, the widest distributed and best known of this genus, has been occasionally found as far south as the coast of New England and New Jersey. The ringed seal (*hispida*) and the harp seal (*groenlandica*) are of Arctic distribution.

Seals are gregarious and migratory. The harbor seal wanders far less than the open-sea species and probably never ventures far beyond the exposed rocky ledges where the young are born. Young seals are at first covered with a thick, white woolly coat, later succeeded by the ordinary hair. Until this change occurs the baby seals do not take to water. It is thought that only one baby seal is produced a year: in case of the ringed seal, which lives almost exclusively on the ice floes, an excavation is made under the snow communicating with a hole through the ice, and here the baby seal will remain several weeks under the care of the mother.

The common harbor seal is gentle and affectionate, quite tamable. They have become so thoroughly aquatic that when pursued by enemies they invariably seek refuge in deep water. Yet by choice they remain near shore, and along the New England coast in late summer and autumn may be seen sprawling on wave-splashed rocks and retired beaches. These seals are thought to enter the mouths of rivers with the incoming tide, often swimming a hundred

miles in search of some quiet pool where fish may still be abundant.

Though a dead seal of this species has little value and can seldom be secured, fishermen and duck hunters shoot at the harbor seal on every occasion. Their own deep-sea enemies are sharks and swordfish and, farther north, polar bears. From these enemies, particularly the polar bear, the seal is not safe even while resting on floating ice. These powerful animals have learned the trick of throwing their weight against the edge of an ice cake, destroying the equilibrium and forcing the unsuspecting prey to slide off into deep water; or swimming round to leeward under water they cut off the seal's retreat to safety.

The two northern species which are slaughtered in numbers in their breeding grounds furnish skins and oil of great commercial value. The skins must not be confused, however, with that of the sea bear (the Alaska fur seal), from which come the expensive sealskins of the furrier.

Harbor seals are seldom to be seen below the northern New England coast except in winter when the southerly limit is often greatly extended.

III

THE CATS

Family *Felidae*

The cat family comprises digitigrade carnivores of medium or large size; they have five toes in front, four behind; tail various; head short and round; claws sharp, curved and retractile; teeth twenty-eight or thirty.

The genus lynx comprises large cats with very short tails (*i. e.*, less than one half the length of the body), very long legs, large feet, usually with tufted ears

I. Canada Lynx

Lynx canadensis (Kerr)

(Called also *Bobcat, Loup Cervier*)

Length—40 inches.—(S. & C.)

Description—Feet much larger than in the wildcat, tail shorter, fur much longer and looser. Color light gray mottled with brownish, caused partly by the dark bases to the hairs, tips of ears with tufts of long black hairs. Under parts white, tail tipped with black, face-ruff long, white bordered with black.—(S. & C.)

Weight—Adults will run from 20 pounds to a probable maximum of 40 pounds for a heavy male.

Range—All Canada and in the eastern United States formerly as far south as the mountains of Pennsylvania. Replaced in Newfoundland and Alaska by allied races. —(S. & C.)

The Canada lynx is a savage, flat-faced beast with muscular legs and claws out of all proportion to the lean body and absurd bobtail. When seen alive it looks and behaves exactly like a huge gray cat. From the wildcat, or bay lynx (*Lynx ruffus*) it may easily be distinguished by a comparison of the tails: the lynx has the tip of the tail wholly black above and below and the rest of it grayish white; the bay lynx has the tip black above and white below, and also has other broken bars on the upper part.

The lynx travels with silent leaps. His broad paws support him on the snow, or, moving without a sound on brittle twigs and dry leaves, he pounces on grouse or hare before they have time to take alarm. He climbs trees with ease and robs nests of birds and squirrels; or he may stretch himself for hours almost invisible on some lower branch from which he may launch himself with lightning speed on whatever chances to pass below. Yet with all their watchfulness they must pass many winter days with hardly a scrap of food, maintaining their strength in the astonishing fashion the flesh eaters do, and constantly hoping for stray prowlers or for spring that will bring out the hibernating animals from their safe nests underground. —(S. & C.)

The lynx is generally believed to be a wide ranger, particularly in the autumn and winter. At this time bands of four or five are often to be seen together and are thought by hunters to represent the family of the year, the mother and cubs and possibly at times the father.

Lynxes are generally supposed to pair. Mating occurs in March and the period of gestation is apparently about three months. The youngsters have much the appearance

of kittens. After two or three months the family (whether accompanied by the father is uncertain) set forth on their travels. At this time the youngsters begin hunting for themselves.

The lynx has probably, available for amusement or for intercommunication, all the vocal manifestations of the house cat. The lynx has another vocal effort that is even better developed than in the cat, and that is a yowling song. This begins with a long, low "*me-ow*," followed by others in quick succession, with rising pitch and volume, till after three or four minutes' continuous performance the final "*me-ows*" are terrific screeches. I have heard this in August, October, and December, and do not know which sex utters it. But the trappers tell me that the somewhat similar and frightful caterwauling of the males is mostly heard early in March and has a direct relation to the mating.

Although a desperate fighter when cornered, the lynx in a snare may be easily killed with a blow of a stout stick. Even a small dog is quite likely to drive him up a tree; but he will usually regain courage, come down, and dispatch the dog, unless the hunter comes quickly to assistance. The lynx is surprisingly slow on level ground: a dog should be able to overtake him within a hundred yards. There are even stories of men who have been able to run him down in the open.

The food consists of several species of grouse and other birds, the Northern hare, gray rabbit, chipping squirrel, snakes, frogs, insects, probably every living creature the lynx may be able to overcome with the exceptions of the skunk and porcupine, which it is inclined to leave alone. A good rabbit year is invariably a good lynx year, and the

disappearance of the rabbits is accompanied by a general disappearance of the lynxes. Hearne, speaking of the Hudson Bay region, declares "that they seldom leave a place which is frequented by rabbits till they have killed nearly all of them."

There are many reports of the lynx leaping down on deer or caribou, but it seems hardly probable that they make a practice of doing so. The lynx has a well-known habit of sneaking along the hunter's trail after dark; generally, however, having come close enough to wind him or to satisfy curiosity, the prowler will pass on his way. There are believed to be no recorded instances of a lynx having voluntarily attacked man.

The lynx is generally credited with the habit of burying in the snow or earth such supply of food as it can accumulate beyond the needs of pressing necessity.

This wild animal is quite easily taken in a snare. Bait is set in a forked stick, surrounded by a fence with one opening. At this opening wire or cord in the form of a noose is set eighteen inches from the ground and fast to a short thick stick. The lynx, sniffing at the bait, is caught in the noose, and, as he retires, the noose tightens until he strangles himself; or, climbing a tree to avoid the encumbrance, he is hanged through the crosspiece catching in the branches. The old-fashioned noose is far more humane than the steel trap in which the animal will probably starve to death unless the trapper comes often on his rounds.

For causes which will probably never be fully ascertained, the lynx population of the Northwest is subject to great fluctuations, the maximum being perhaps ten times the minimum. Trappers and fur traders believe that the

lynx migrates. J. K. McDonald, an old Hudson Bay trader, is quoted as saying:

"It is accepted as a matter beyond cavil by all the Hudson Bay hunters that the hare, lynx, and marten do migrate, and the fluctuation in their numbers is not considered to be caused by epidemics—save in the case of the hare. Were it so with the lynx, for instance, their bodies would surely be found, yet I have not heard of such a thing. It is always the case that when lynx and marten are plentiful, so are the hares. . . . These periodical waves of increase or decrease cover large tracts of country and it might be found that where in one tract they were moving east, in another they were going west."

While there is certainly evidence of local migrations, there is hardly enough to account for the cycles of rise and fall of the lynx population. The decrease is most probably due to the starvation caused by the failure of the rabbit supply and it is undoubtedly true that, as the rabbit increases, so will the lynx.

Lynx fur is a staple of the Northwest trade. An average of the total exports for a number of years past will show about 30,000 lynx killed each year for their fur; the figures of the Hudson's Bay Company have sunk for a year as low as 4,000 and climbed as high as 75,000.

II. Cougar

Felis couguar (Kerr)

(Called also *Puma, Mountain Lion, Panther, Painter*)

(S. & C.)

Length—8 feet 6 inches; tail, 3 feet.

Description—Body relatively longer than in the lynx,

tail very much longer, no tufts on the ears. General color pale rufous or yellowish brown, darker along the back and tail, tip of tail blackish; face grayer, under parts dirty white.

Range—Formerly eastern North America, now probably extinct, though a closely allied variety, the Florida Cougar, still exists in Florida, and others from the Rocky Mountains westward and south throughout South America.

Apart from the blood-curdling tales of most doubtful authenticity with which every one is familiar, accounts pretty generally agree in stigmatizing the cougar as an arrant coward. The truth seems to be that, like all the other wild beasts of this country, his race has learned through bitter experience that the only possible chance of life is to keep out of man's way. Whenever an American wolf, bear, or cougar has disobeyed this rule, he has almost invariably been killed or badly wounded at once. No wonder that the survivors have learned caution.

If India, for example, had been inhabited by tribes of wild men, born hunters like almost every tribe of our American Indian, and finally settled by frontiersmen and backwoodsmen, who never entered the woods without an ax or a gun, it is highly probable that reliable accounts of human beings having been attacked by either leopards or tigers would be almost unknown.

Man-eating tigers have for so long been regarded by the natives of most parts of India as invincible, or else protected by the native religions, that they have had things pretty much their own way. . . . Many tribes of North American Indians looked upon the bear with vener-

ation; but for all that, any bear so courageous as to let himself be seen by them got an arrow between his ribs right away, and in time the whole tribe of American bears learned that the chances were against them, just as the wolves and cougars arrived at a similar conclusion.

When the white man came the wild beasts of the wilderness found that they had a yet more dangerous enemy to face. The guns of the early settlers were not very handy or reliable weapons, but when they did go off they were capable of scattering half a handful of slugs in the most painful manner; and from that time to this there has hardly been an opportunity for the slyest cougar to attack man, woman, or child without bringing down sudden and awful retribution on his head.

When it comes to a question of fighting on anything like equal terms, the cougar is by no means a coward. In a fair fight, a full grown male cougar could kill the largest dog without much trouble. Even now they kill cattle and horses from time to time, though every such indiscretion on their part is a challenge to the enraged owner, with his Winchester, bear-trap, or strychnine.

Although originally found in every wooded part of the United States, they were so quickly driven off by the settlers that not much is known of their habits here in the East. A few have lingered along in the wilder districts of the northeastern states even down to the present day; but their every footprint has been eagerly searched for and heavy steel traps set where they were likely to step; while the slightest rumor of a panther in the region would call out scores of zealous hunters armed with shotguns loaded with buckshot and rifles of every description, and accompanied by dogs of all breeds for tracking.

The last cougar killed here in northeastern New Hampshire, where I write, was shot in a neighboring town something like forty years ago. But there are still rumors from time to time of their having been seen in the northern part of the state, especially since deer have become more common. In the eastern states they appear to have made their homes in hollow trees oftener than among the ledges, while in fair weather they were given to sleeping out-of-doors, stretched along a branch in the shade. On their hunting excursions they steal noiselessly and cat-like through the thickets, scarcely displacing a twig, still-hunting being their favorite method of obtaining food. Though usually silent, they at times utter a loud penetrating scream.

Among hunters there is a pretty widespread theory that the cougar's change in color follows the seasonal change of the wild deer's coat, becoming more or less spotted in summer to imitate the young fawns. This is, however, quite erroneous, for although the kittens, like those of all the cat tribe, are spotted, the adults are never mottled. The shade varies in winter and summer, and there seems to be a good deal of individual variation, some being browner and others more of a blue gray.

In Mr. Theodore Roosevelt's admirable article on the cougar in *Scribner's Magazine* he writes: "Fables aside, the cougar is a very interesting creature. It is found from the cold, desolate plains of Patagonia to north of the Canadian line, and lives alike among the snow-clad peaks of the Andes and in the steaming forests of the Amazon. Doubtless careful investigation will disclose several varying forms in an animal found over such immense tracts of country and living under such utterly

diverse conditions. But in its essential habits and traits the big, slinking, nearly uni-colored cat seems to be much the same everywhere, whether living in mountain, open plain, or forest, under Arctic cold or tropic heat. When the settlements become thick it retires to dense forest, dark swamp, or inaccessible mountain gorge, and moves about only at night. In wilder regions it not infrequently roams during the day and ventures freely into the open. Deer are its customary prey where they are plentiful, bucks, does and fawns being killed indifferently. Usually the deer is killed almost instantly, but occasionally there is quite a scuffle, in which the cougar may get bruised, though as far as I know, never seriously. It is also a dreaded enemy of sheep, pigs, calves, and especially colts, and when pressed by hunger a big male cougar will kill a full-grown horse or cow, moose or wapiti. It is the special enemy of the mountain sheep. In 1886, while hunting white goats north of Clark's fork of the Columbia, in a region where cougar were common, I found them preying as freely on the goats as on the deer. It rarely catches antelope, but is quick to seize rabbits, other small beasts, and even porcupines.

"No animal, not even the wolf, is so rarely seen or so difficult to get without dogs. There are many contradictions in its character. Like the American wolf, it is certainly very much afraid of man; yet it habitually follows the trail of the hunter or solitary traveller, dogging his footsteps, itself always unseen. When hungry it will seize and carry off any dog, yet it will sometimes go up a tree when pursued even by a single small dog wholly unable to do it the least harm. It is small wonder that the average frontier settler should grow to regard almost

with superstition the great furtive cat which he never sees but of whose presence he is ever aware. The cougar is as large, as powerful, and as formidably armed as the Indian panther, and quite as well able to attack man; yet the instances of its having done so are exceedingly rare. But it is foolish to deny that such attacks on human beings ever occur. . . . It cannot be too often repeated that we must never lose sight of the individual variation in character and conduct among wild beasts."

III. Mexican Jaguar

Felis hermandezii

(S. & C.)

Length—7 feet; tail, 2 feet.

Description—A large leopard-like animal, tawny yellow above, white below, spotted with black along the back, and with black, light-centered rosettes on the sides, each with a central black dot. Tail ringed black and yellow.

Range—Lower Louisiana, Texas, New Mexico, and Mexico, and represented by allied varieties in Central and South America.

This large cat, though common in Mexico, is of rare occurrence within the borders of our country, and like other species of southern Texas, is only a straggler from farther south. Where plentiful, it preys on all sorts of animals, even overcoming the tapir with ease. Stories are told of its attacking Indians, but, as has been said, "truth and fiction" are so hopelessly mingled in such tales that it is best to withhold credence in most cases.

IV. Ocelot

Felis pardalis Linnæus

(S. & C.)

Length—45 inches; tail, 15 inches.

Description—Color rufous tawny or brownish with blackish spots, rosettes and stripes, very variable in pattern. Below white with black spots.

Range—Lower Louisiana and Texas, throughout South America.

This is a small spotted cat, ranging from the tropics to just within our borders. It is very variable in color and doubtless when carefully studied will prove to present several well-marked varieties. Its habits within the United States are very little known.

IV

THE DOG

Family *Canidae*

The dogs and their allies, the wolves and foxes, resemble the cats in being digitigrade, or walking on the toes, and in having only four toes on the hind feet. Their claws, however, are duller, shorter, and not retractile.—(S. & C.)

I. Kit Fox

Vulpes velox (Say)

(Also called *Swift*)

Length—25 inches.—(S. & C.)

Description—Yellowish gray above, darkest on the back, hairs tipped with whitish, legs lighter; under parts white; tail buffy below, tip white, very full and bushy; a black patch on each side of the muzzle.—(S. & C.)

Range—Nebraska to Colorado and northward over the Plains.—(S. & C.)

This small fox, about the size of a house cat, is an inhabitant of the Western prairies. The little animals live in burrows from which they seldom venture far away. A typical den might be reached by a tunnel nine feet long reaching down five feet from the surface and at the end would contain the nest neatly lined with grass.

The prairie kits are not a numerous race and little is known of mating habits. It is thought that possibly they pair for life, certainly for the season, as the male is known to be active in the care of the young.

Kits prey chiefly on mice and occasionally have been seen to catch prairie chickens that lay hidden in the snowdrifts. Though the name "Swift" was given the kit under the erroneous theory that it was the swiftest of the four-footed creatures of the plains, its speed should be placed only slightly higher than that of the coyote. The rapidity with which the small animal gets under way and disappears into a hole helps give a wrong impression of velocity.

In captivity the kit breeds freely and is easily managed.

II. Red Fox

Vulpes fulvus (Desmarest)

(Called also *Cross Fox, Silver Fox, Black Fox*)

Length—40 inches.—(S. & C.)

Description—Fulvous or rusty red, grayish on the rump and flanks; hairs of the tail black, toward the end tip of tail whitish; legs black, partly white on the inside; throat white; ears largely tipped with black.—(S. & C.)

Considerable variation occurs in coloration, especially in the northern part of the range. The cross fox is similar, but with a black band across the shoulders and another along the back. The silver fox is a gray and the black fox a black phase of the same animal.—(S. & C.)

Range—Northern North America south to Georgia, replaced in Nova Scotia and Newfoundland by slightly different varieties.—(S. & C.)

The red fox holds his own against man as much by boldness and audacity as by caution; few of the wild animals survey the invader with as little awe.—(S. & C.)

The reputation for shrewdness and cunning which this animal has always borne is well earned and indisputable. The early settlers found little difficulty in trapping the fox, and even now those still remaining in wild unsettled country are comparatively easy to outwit. But one of the most characteristic traits of the animal is the quickness with which he gathers experience and learns to avoid new dangers. And the fox of cultivated regions has in the matter of a highly developed intellect almost caught up with the famous Mons. Reynard of song and story. —(S. & C.)

The fox flourishes in half-open regions and the home locality is probably not more than five miles across. When pursued by dogs, he usually circles at a radius of two or three miles. In winter he is more inclined to be a wanderer, covering perhaps a range of a dozen miles in diameter.

There seems to be a general belief among naturalists that the fox truly pairs, the only question remaining being whether pairing is for the season or for life. Much evidence of foxes consorting in pairs after the breeding season is available, but the matter cannot perhaps be considered as absolutely settled at the present time.

In the pairing season the she fox utters a very characteristic shrill squall. The reply of the male is usually two or three short barks. At other times the fox has a short bark followed by a little squall that sounds like *yapyurr*. The voice of the male is notably heavier and coarser than that of the female.

The rapid disappearance of many wild fur-bearing

animals combined with the steady demand for good furs has led to the idea of artificially supplying the demand. From fox farms where foxes are bred for furs and from those bred in zoölogical gardens we have been able to add considerably to our knowledge regarding the mating of the fox. The wild fox mates in late January or early February; the captives four or five weeks later. The period of gestation is fifty-one days practically without variation. The young number three to nine with most likely six or seven in a litter. They are born blind, their eyes opening about the seventh or eighth day. When a month old they come out and play with each other like kittens. At three months they are weaned and begin to eat solid food. At midsummer they will be half grown and by the following February or March, while less than a year old, they will begin to breed.

In captivity the father is not needed to forage for the young and is generally excluded from the pen. The quieter the mother is, the better. The young should not be approached or displayed to strangers. If disturbed or frightened, the mother is liable to carry her offspring about in her mouth seeking a better place for them, until perhaps they are worried to death.

Interesting observations have been made on the feeding of foxes in captivity. Fox farmers feed their foxes on bread, table scraps, and occasionally a little meat. A diet of rabbits and mice has been found too rich for animals restrained in captivity. In general, the most satisfactory food for foxes is about what it would be for dogs.

The best speed of an average fox for a mile is estimated to be about twenty-six miles an hour, faster than a coyote but slower than a jack rabbit. The bushy

tail, quite meagre in the foxes of the Southern States, becomes enormous in those of Hudson Bay and the Far North. In severe weather the brush curled about nose and pads (the only exposed parts) serves both as a wrap and as a respirator. In Arctic regions a fox or coyote would probably die before spring if turned out in the autumn without a tail.

In early winter the fox will probably hunt chiefly at dusk, but in February or March he may be seen abroad at all hours. Reynard travels an up-wind course, turning aside to examine every thicket that looks promising. He freezes to a statue on the slightest click of leaf or twig; or he may bound aloft for an observation hop after the manner of a jack rabbit. He trots on, hour by hour, missing nothing, passing from cover to cover in a somewhat zigzag line, but in a general up-wind course. When tired or satisfied he lies down for a nap, not usually in a hollow, but on some exposed place, the top of a bank, a boulder, a log, or a stump.

The den is the nursery of the fox. The den is used when the cubs are nursing and only occasionally as a year-round abiding place. Dens have been discovered in hollow logs, in the bases of standing trees, and hollowed out of the ground. If in the ground, the nest will be in a dry chamber a dozen or more feet from the door, lined probably with a little grass. The den may have several entrances; there may be an earth pile before the door, but fully as often the fox scatters all excavated dirt. Often the fox uses the abandoned home of some other animal, adapting it to his needs.

Foxes have little use for a den in winter, nor do they have regular hours for sleeping. As a general rule they

prefer to sleep by sunlight, but sleep is quite likely to be broken up into a half-dozen naps.

The fox is popularly supposed to subsist chiefly on poultry, rabbits, and game birds; probably, however, mice form the largest part of his diet during the summer months. He spends much time slaying mice or hunting for mice. A squeak or a slight movement of the grass tops and he springs for the root of a vibrating spear, slaying with a nip the mouse that he scarcely sees. Stone and Cram tell amusingly of an effort to deceive a fox with the false squeak of a meadow mouse:

"Presently I saw Reynard himself trotting along at the edge of a pine grove. . . . He was at least one hundred and fifty yards away and going from me, but the air was still and I squeaked like a meadow mouse, hoping that perhaps his big ears might catch the sound even at that distance, though the sharpest human ears could scarcely have heard so faint a noise at a tenth part of the distance.

"Yet the fox heard it and stopped instantly, and turning, came leaping lightly over the hassocks in my direction. Every few rods he stopped, cocking his ears above the sere meadowgrass to listen; then I would squeak, a little lower each time, and instantly, catching the direction of the sound, he would come trotting toward me, using greater caution than at first, and keeping under cover of the hassocks as if to avoid frightening his game. When he got within fifty yards there were no more hassocks or bunches of grass for concealment, only the smooth sheep-trimmed sod where I crouched in plain sight. . . . He looked at me sharply as if mistrusting something, and if I had moved either my head or hand the fraction of an

inch he would have been off like an arrow to the woods. But I held myself perfectly motionless and when the expression of his shrewd gray face and the set of his ears showed that his suspicions were subsiding, I squeaked once more, very faintly, calling him at last almost up to me. But now he saw that there was certainly something wrong. . . . So he circled round to get the wind of me, trusting more to his nostrils than to his eyesight. . . . When I spoke to him, he sprang into the air and went bounding away to the woods, then stopped and looked back at me for a few seconds before disappearing among the trees."

Foxes, like other members of the dog family, store up food when they have more than they need. On the fox farms the captives bury such extra supplies as they do not for the moment care to consume. They watch other foxes that approach these hiding places and show fight immediately if attempt is made to pilfer stores. They dig up buried supplies as soon as hungry and if there are still more than is wanted they are recached in another place. Some observers have even credited the fox with laying up considerable stores of supplies for winter use which he is able to detect even under several feet of snow. The fox has been observed to lay up a store of eggs of the wild fowl, depositing his treasure in holes dug in the sand bars of a river or in beds of moss: it is uncertain, however, whether this habit is in any way general.

Well-authenticated records show a fox to be old at ten years and rarely to reach the age of fifteen. There is the record in England of an old fox known to have run before the local hounds three or four times a year for seven years before being brought down.

In the wild there can be little doubt that wolves, lynxes, and fishers prey upon Reynard and that these larger beasts as well as the larger birds destroy the young foxes wherever found.

The sea otter produces the most valuable fur in the world, and next to the sea otter comes the black or silver fox. This is a freak of the common red fox and is intense black with more or less silver tipping of the hairs on the head and rump, the less tipping the higher the value. Of the common red fox the accurate records kept by the Hudson's Bay Company show a total of 1,536,420 skins collected covering the years 1821–1905. The pelt of the silver fox being on account of its rarity so far in advance of the common red fox in value, the efforts of those who have started fox breeding commercially have naturally gone to the production of silver foxes. The problem, however, presents many difficulties. A pair of red foxes may have a silver fox in their litter, but the silver fox in his turn is quite likely to disappoint the owner by producing nothing but red fox cubs. A prime red pelt may be worth no more than from $2.00 to $4.00, while the standard quotations on silvers will run from $50.00 to $200.00 (recently all fur pelts have gone up to extraordinary figures).

We will conclude this notice of the red fox with a brief mention of the little Arctic blue fox (*Vulpes lagopus*). The little blue foxes live in fox villages, digging often as many as twenty or thirty burrows in the sandy soil. In summer they feast on lemmings and the eggs of wild fowl. But summer is of short duration in the land of the Arctic fox. While game is still abundant the provident fox makes extensive caches of lemmings which he arranges

deep down in the moist turf below the frost line, covering his supplies with moss and sods.—(S. & C.)

In the autumn his fur becomes a clear white and he can creep unseen among the snowdrifts as he searches for game or avoids his great enemy, the gray wolf. It is generally believed that the young foxes of the year who have not established homes or laid up stores of food, travel southward on the approach of winter, and do not return till the days again begin to lengthen, when they arrive north again. They dig burrows and prepare stores of lemmings for themselves, but not for their cubs, who must in their turn travel south hunting for themselves or else go hungry.—(S. & C.)

The Arctic fox is neat and cleanly, a more attractive but not as intelligent an animal as its relative, the red fox of temperate climes. However, did he live nearer the habitations of man, he would doubtless soon become as difficult to outwit as other members of the fox species.

—(S. & C.)

III. Gray Wolf

Canis occidentalis (Richardson)

(Called also *Timber Wolf*, *Buffalo Wolf*)

Length—4 feet 9 inches.—(S. & C.)

Description—Prevailing color gray; dark, almost black along the back with a dusky patch on the shoulder and hips.—(S. & C.)

Range—Formerly over most of North America, now very rare east of the Mississippi River.—(S. & C.)

The genus *Canis* is composed of true dogs. They have long, pointed muzzles, long legs, long bushy tails, and

pointed ears; have four toes on each hind foot, and five on each front, but the innermost of the five toes is very short and small; claws are blunt and non-retractile.

The North American gray wolf, now almost extinct in this country, is practically the same as the dreaded gray wolf of Europe that still menaces the peasantry of Russia and Germany whenever an exceptionally long winter drives the brutes to desperation.—(S. & C.)

The wolf is a flesh-eater whose food supply is very uncertain. It is probable, therefore, that the home range is greater than that of almost any other non-migrating animal. In New Mexico several wolves have been reported to have become known by individual marks and are thought to be permanent residents of a region about thirty miles across; and in Dakota, near Medora, a wolf became so well known as to receive the name of "Mountain Billy." A summer range of fifty miles will probably be as near as it is possible to locate the gray wolf: in winter the range will be naturally much larger.

The great hordes of wolves that followed the buffalo as the buffalo were gradually driven back across the Plains and the herds broken up, disappeared when the buffalo disappeared. According to the best estimates that can now be made, there are between five thousand and ten thousand gray wolves in Wyoming alone, and they are in like proportion over all the cattle country from the Gulf of Mexico to the Saskatchewan. On the basis of the lower figures, there would be a total of perhaps a half million gray wolves still roaming the West (1909).

The wolves gather in bands to render each other assistance, being by far the most sociable of the beasts of prey. Packs may range from no more than three or four indi-

viduals up to fighting aggregations of thirty or forty. These seem always mere temporary associations of personal acquaintances, for some temporary purpose, such as food supply or mating instinct. As soon as this is settled, the band disintegrates. They are probably not gregarious in the sense that the antelope and wapiti are.

The nursery den is most likely to be a natural cave, or a hollow log, occasionally a hole dug in the ground. Here the cubs are born, usually six or seven in a litter, after a period of gestation of sixty-three days.

The mating season begins about the last week in January and may last into the first week in March. The gray wolf certainly pairs and there is evidence that this may be for life. The well-nigh-universal belief of trappers and fur traders seems to be that the male assists the female in caring for the young, either by foraging supplies or by standing watch while the female is away. Vernon Bailey declares: "Men who have made a business of hunting wolves for the bounty assert that they are usually able to shoot one or both of the old wolves at the den by watching the trails, or hiding near the den early in the morning before the wolves return from the night's round."

The maternal instincts of the she-wolf are of a higher order than those of the prairie wolf, which has been known to kill its young and also to eat them when they have died of natural causes. Cubs, observed in zoos, begin to whine like puppies as soon as born. When three or four weeks old they come out to sit and play in the sun. For a period that is not exactly determined, but is probably about six weeks, the mother suckles the cubs. After that there is much testimony that the mother disgorges solid food for them, the cubs jumping at her mouth until she supplies

them. As they grow older they are able to tear and eat rabbits and chickens which the father brings and deposits at the mouth of the den.

About this time begins the education on which the life of the cubs will depend. By the force of example they learn what is necessary for them to obtain success in life. By showing *her* terror of the trap, the mother makes them understand that a trap is a thing to keep away from. Poison was for a long time successfully employed, but presently the wolves began to acquire knowledge of the evil powers associated with the smell of strychnine and would no longer touch the poisoned bait. How is this knowledge passed on from wolf to wolf? We cannot tell, but it is well known among cattlemen that nowadays almost the only chance of poisoning wolves is in the early autumn when the cubs are beginning to run with the mother. They have not yet been made to understand the death-dealing quality of the evil smell and the mother at times will be unable to watch over her entire family.

The gray wolves, of whom many terrible tales have been recorded in histories of early times, have undoubtedly been educated by fear to let man alone. The wolf is nowadays among the shyest of wild animals. It is said that men have lived a large part of their lives in gray wolf country and yet have never set eyes on a gray wolf. They will hear them at night, they will see their trails in the morning: and they will set traps for them which the wolves will carefully avoid. Yet before the advent of guns and poison the gray wolf seems to have considered man, not as lawful prey perhaps, but certainly as a resource in times of famine and scarcity.

The long smooth howl of the wolf is decidedly eerie when

heard late at night. Three calls may be distinguished: the muster, or rallying cry, the intimation of a wolf to his friends that he has found game too strong for him to manage alone; a higher pitched howl vibrating on two notes, the hunting song of the pack on a hot scent; the third, a combination of short bark and howl, seems to mean the closing in for a finish. The wolf is also thought to have developed to an extraordinary degree the system of intercommunication by odor posts scattered at convenient intervals through wolf country of which one may see the rudiments in the habits of the domestic dog. Through these posts the wolf is thought to be able to determine the progress of matters in which he is interested, the passing of friend or foe, and the direction that has been taken.

The great strength of the animal is in his jaws, and it is generally believed that no dog, however powerful, will be a match singlehanded for a grown wolf. Many surprising tales of long distances that the wolf has been able to drag heavy steel traps are current among hunters and trappers. Endurance is equally remarkable: a wolf can live on one full meal a week and a dozen meals, well spaced, will carry it through the worst of winter. On the contrary, the speed of the gray wolf has probably been exaggerated. I estimate the pace for one mile to be less than coyote, jack rabbit, deer, antelope, greyhound, or even fox hound; but the wolf can keep the pace up for a longer time than other wild animals.

The Eskimo dogs are generally merely domesticated wolves mixed with a strain of other dog stock. The full-blooded wolf is not usually considered as good a train dog as the half-breed, being always more or less sly and inclined to watch its driver in cowed fashion. The wild

wolves among the huskies (as the half-breeds are called) are readily to be detected, as their tails are rarely above level, or curled up, while a husky's is always excessively curled. Wolves, when caught young, have been known to become surprisingly tame, to play and gambol with other dogs about camps; but there is always a possibility that savage nature may suddenly break out, as many campfire stories testify.

Rabies, mange, and scab are known at various times to have broken out among wolves, and mad wolves have been occasionally reputed to have attacked grown men.

Wolves are so rarely seen that pitfalls and traps were about the only means of extermination before poisoning by strychnine became established. The Indians caught many in pitfalls as is testified in Henry's well-known journal. Henry says: "We had now a well-beaten path, but were several times in danger of breaking our necks in deep pits which the natives had dug in the path to catch wolves and foxes in winter. Some of them are ten feet deep, hollowed out to a space about thirty feet in circumference, whilst the entrance is no wider than the foot path and about five feet in length. These holes are covered with dry grass at the season when wolves are good, and every morning are found to contain some of these animals. In summer the grass grows strong and high about the mouths, entirely concealing them, until one arrives upon the very brink and is in danger of tumbling in headlong."

Steel traps have accounted for many wolves, whatever may be said or left unsaid regarding the humanity of the device. The ranchman is inclined to reason this way: wolves would ruin the cattle business in a very few years

if we did not keep them down; we trap and poison not for the fun of it, but as a very matter of existence.

Traps are arranged in many ways. At the meeting place of several trails a lump of meat is often buried, and near by several traps rubbed with blood and never touched with bare hands. Each trap is fastened to log or rock weighing forty or fifty pounds. Dry dust is sprinkled everywhere, a few weeds scattered about, the foot of wolf or coyote is used to make a track or two across the mined space. At the conclusion of the preparations drag, bait, trap are all hidden. Or the bait may be set three or four feet above ground in a rough place: the wolf, circling about in the open as he sniffs the meat, falls into the traps that have been sunk in level ground. Or, the device may be set under water, the water disguising more effectively the smell of the iron than it is probably possible to do with a land trap.

In this arrangement the bait will be set a little farther out from shore; the wolf reaching forward to sniff will usually set a foot on a convenient dry stone protruding from the water (the trap) and is caught.

When caught between steel jaws a wolf bounds away with all his strength. As traps are always fastened to a log or boulder that will yield a little, the imprisoned animal merely wears himself out in his efforts to break away. Recently Vernon Bailey has called attention to a fact that has not been sufficiently utilized in trapping wolves. Since the snow is usually on the ground in March when the young wolves are born, it should be easy to track the parents to their den, and being definitely located they should be exterminated without difficulty. This is a more valuable discovery than appears on the surface, because

the wolves become very wary of traps planted in the open; if their dens can be located the wolf population can be easily kept in hand.

The fur is rich and beautiful but is not especially durable.

IV. Coyote

Canis latrans (Say)

(Also called *Prairie Wolf*, *Brush Wolf*)

Length—4 feet.—(S. & C.)

Description—General color fulvous, grizzled with black and white hairs; under parts whitish; tail tipped with black.—(S. & C.)

Range—Northern Mississippi Valley to the Rocky Mountains, with allied species south to Texas and Mexico and westward to California and British Columbia. —(S. & C.)

Coyotes combine the swiftness, cunning, and greed of the wolves and the foxes. They lack the vigor and the ferociousness of the gray or timber wolf. They live mostly in burrows on the plains and feed principally on jack rabbits, ground squirrels, and mice.

Scientists have recognized and drawn up many classifications with varying minor peculiarities, but all coyotes will be found to agree in two particulars: that they prefer the untimbered portions of the country and that they are all barkers and howlers. The home range of a pair of coyotes (the coyote is monogamous) will probably be no more than six square miles in summer and possibly twice as much in winter. Drawing up an estimate on the strength of the number of bounties paid in various states

and in Manitoba in 1904, I consider there are probably one million large coyotes in the total range of two million square miles suited to their life and development.

The mating season is about the middle or during the last two weeks in February. As a den, the coyotes use an old badger hole, or else dig one for themselves in some sunny bank. The entrance is about ten by twenty inches and is commonly concealed amid bushes. Over the nest is usually an air hole to admit fresh air to the cubs. Sometimes the nest is lined with a little fur and grass, but more often seems to be quite bare.

The litter is from three to ten, but most usually five to seven. They are born blind and helpless, covered with close, dark, ash-colored fur. Doctor Hornaday made observations on young born in the New York Zoölogical Park. Their eyes opened on eighth and ninth days variously. When about three weeks old the mother would carry them out into the sun, or about the yard and back again. At five weeks they were old enough to walk out alone.

In the wild the young are so eager to welcome father and mother back with the new catch that they make little pathways from the den to all the near points that give a view. By July they are half grown. Now they begin to run with their parents and to learn the arts of hunting. By October they are as big as the parents and the family begins to scatter.

Food will include ground squirrels, mice, rabbits, frogs, snakes, eggs, and young birds. Besides all this regular fare the coyotes, working in pairs, occasionally run down as large an animal as an antelope. The strategy of the coyotes consists in working at some distance apart and

keeping the antelope running zigzag between them until the antelope, exhausted by continuous effort, becomes an easy prey. Dr. George Bird Grinnell in an interesting article on "Coyote Partnership" which we can do no more than condense, tells of an antelope chased by two coyotes round a wide hill.

"Just before I got to the top of the hill an old doe antelope suddenly came in view, closely followed by a coyote. Both of them seemed to be running as hard as they could and both had their tongues out as if they had come a long way. Suddenly, almost at the heels of the antelope—much closer to her than the other wolf—appeared a second coyote, which now took up the running, while the one who had been chasing her stopped and sat down and watched. After a little it was evident that the antelope would come back pretty near to the hill, but on the other side of it . . . and the wolf I had first seen chasing her trotted out 200 or 300 yards on to the prairie and sat down. The antelope was now coming back almost directly toward him and I could see that there were two wolves behind her, one close to her heels and the other a good way farther back. . . . When the antelope reached the place where the first wolf was lying hidden, he sprang up and in a jump or two caught her neck and threw her down. At the same moment the two wolves from behind came up, and for a moment there was a scuffle in which yellow and white and gray and waving tails were all mixed up, and then the three wolves were seen standing there tearing away at their breakfast."

A coyote is the only wild animal that habitually barks. Some of the coyote calls are signals to companions; others seem to be solely the outcome of the primitive pleasure of making a noise. The evening song of the coyotes, a

series of short barks increasing in power and pitch into a long squall, has been much commented upon. One coyote begins, two or three others join the song, and presently in the darkness one might readily believe he was listening to a hundred. The sound the old coyote utters when the young are in danger is described by A. S. Barton as a loud, short, rough squall. Barton notes also that two or three coyotes will meet each night on a certain elevated place to sing. They have several of these recognized choir lofts, but they never use the same one two nights in succession. Sometimes on Turtle Mountain, in dead calm moonlight nights, each coyote gets up on his singing perch and pours out his loudest and finest notes. This is passed on from one point to another, till the whole mountain seems ringing with weird music, and from its very wildness and the vast stretch of the country that is concerned the effect is truly impressive.

The speed of the coyote has been the subject of much admiring comment, but I consider it probably overrated. I am forced to set the coyote back of the jack rabbit and common fox, but ahead of the fox hound and gray wolf. What actually counts in the race is the trifle more speed that each animal can command. If the gray wolf makes 650 yards to the minute and the coyote 700, the 50-yard margin will be the salvation of the coyote race. Yet it is probable that individual coyotes will have a speed that will put them near the top of the animal list.

Through the autumn season small game of all sorts is to be found in abundance and the coyotes grow sleek and fat in preparation for the hard time of winter. Winter is the crucial test of any species which does not hibernate. Probably winter-killed sheep and cattle are all that pull

the coyotes through severe winters; and for each carcass there will be many contenders and often all must retire while a larger animal, perhaps a big gray wolf, will fill his capacious belly. Like other members of the dog family, the coyote manages at times to store away a little additional supply of food, but the habit, as far as observation goes, seems not to be deeply ingrained.

Mentally the animal is a compound of fox and wolf. The trappers say that only one animal is more difficult to coax into traps and that is the wolverine. Ravenous appetite in winter, however, will often get the coyote into trouble, for he will bolt scraps of meat without making sure that none is poisoned. Probably more are disposed of in this fashion than through traps, regarding the nature of which they become speedily very suspicious.

A coyote will tempt a dog to chase him and then, at a safe distance from the dog's human backers, turn on his pursuer and drive him back with vigorous snarls. Many instances of extraordinary mental alertness on the part of the coyote are told and particularly regarding his ability to sense whether man be armed or no. Dr. W. T. Hornaday says:

"The delicacy of the coyote's judgment in keeping always beyond fair gun-shots is truly wonderful. If he is not a mind-reader, his actions belie him. Twice in Montana, each time for two weeks, have I tried my utmost to shoot a coyote; but during those periods not one would offer more than a running shot at three hundred yards or more. Twice, however—and immediately after the above—when riding quite unarmed, have coyotes sat down beside the trail, waited for me to approach within forty yards, then yawned in a bored manner, and slowly trotted

off. It is my belief that those animals knew perfectly well my inability to shoot."

Cased wolf was the old trade name of the coyote, because its skin was cased like that of a muskrat, while the gray wolf's pelt was spread out flat like that of a beaver. The pelt is prime from October to April. The soft yellowish gray is attractive, but coyote is not the right quality to rank among the very valuable furs and has never been able to command a high price. Such skins as are collected are usually made up into great coats or lap robes.

V

WEASELS, OTTERS, ETC.

Family *Mustelidae*

The Weasel family, or *Mustelidae*, are carnivores of long form on short legs, with tail various, ears short, claws non-retractile. The members are closely related so far as skulls and skeletons are concerned, though they present considerable diversity in their external appearance. The typical *Mustelidae* are the slender-bodied weasels. Then there is the heavy-bodied wolverine, which reminds one of a bear; the semi-aquatic otters which indicate the way in which the seals have been evolved, and the flat-bodied badger, the burrowing member of the family.

I. Otter

Lutra canadensis (Schreber)

Length—3 feet 6 inches to 4 feet.—(S. & C.)

Description—Body long and somewhat flattened, feet short, toes webbed, tail very broad and flat at the base, not abruptly constricted where it joins the body. Uniform seal-brown, size variable, males generally larger. —(S. & C.)

Range—Northern North America, south to central New York and Pennsylvania, replaced southward and in Newfoundland by closely allied varieties.—(S. & C.)

The otter has followed a fisherman's life so persistently that he has grown to look more like a sea than a land animal. The otter of our fresh waters swims out from the river's mouth into the deep at times and has been occasionally caught in nets far out at sea. Yet they move about on land in winter time, make regular journeys from one stream to another, or from pond to pond; when fishing is unsuccessful they will even try land hunting, for which their short legs and long heavy bodies are but ill adapted.—(S. & C.)

Frequenting water, or the vicinity of water, the otter finds its ideal surroundings in good-sized clear streams that abound with fish and that are much varied by pools, rapids, log jams, and overhanging rocky banks. All the trappers agree that this species is wide ranging. Many claim that each otter has a certain range that is considered his own little kingdom. He will journey up this river branch and overland to another brook or river, continuing till some landmark or perhaps signs of rival ownership warn him that he has come to the end of his domain. Kennicott credits the otter with following not merely a general course, but an exact pathway when on land.

It is generally believed that the otter pairs and that the mating season is toward the end of February. The period of gestation is presumably sixty-one days as it is with the British species. The young are born in mid-April or sometimes as late as the first of May. Their eyes are closed for a few weeks after birth; they are not weaned till four months old, and at the age of nine months they are thought to be fully adult. Among British otters bred in captivity the male at all times has shown himself of excellent disposition, quite in contrast to that of his relative, the male marten.

The den of the otter has been well described by Kennicott as the result of extensive researches:

"It digs a burrow on the bank at the edge of the stream or lake, with an entrance under water, like that of a muskrat. Its burrow is not so extensive, however, as that of the latter animal, and it never constructs a house of any kind. In a capacious chamber in its burrow it forms a large soft nest of sticks, leaves, and grass; though sometimes it has been observed to take up its quarters in the bottom of a standing hollow tree or in a cavity in a fallen one."

The question as to whether or no animals train their young is one of extraordinary interest. It seems certain that the young need little or no instruction in primitive habits that have been at all times characteristic of the race. As to acquired habits, such as the swimming powers of the otter, the case is not so clear. J. G. Millais, who has made a special study of the otter, says:

"In their preliminary efforts at natation young otters are just as frightened as they can be, and keep querulously calling for their mother all the time she is out of sight. But at first she does not upset their baby natures, and only vanishes for a few minutes. . . . She teaches them to dive noiselessly, to circle in deep pools, and how to come up quickly behind sleeping fish or drive them into holes in the banks. Then they are taught to stir the mud with their pads, or turn over stones for hidden miller's thumbs, and bury their heads in the mud after eels, or how to corner the darting salmon. That the swimming powers and the hunting of fish are acquired habits is shown by the fact that young otters, kept tame and allowed to run loose, are almost full grown before they will take to the

water; they grow up with stoatlike habits; *i. e.*, hunting for their food on land."

The otter is more nocturnal than diurnal. Of tireless habit, it darts and turns, diving or floating. The choicest of fish, the glancing trout and the swift salmon, are at its mercy. It is as long-winded as it is quick. Merriam says that he has known an otter to swim nearly a quarter of a mile without showing its head above the water.

Fish are caught by fairly swimming them down in spite of all their twisting and darting. In good fish water an otter can easily catch ten times as many fish as he desires to eat and will often satisfy himself with a mouthful or two, preferring the flaky meat just back of the head. Otters are excellent judges of fish, selecting trout, salmon, and eels. Horned pout are also favorites and are caught in defiance of their ugly spines; in eating horned pout otters make an exception of their usual rule and begin at the tail, leaving the head and armed neck on the bank. On land the otter has been known to eat fowl and probably at times any sort of small animal that is available; but its steady diet is fish and always fish of the choicest variety. The otter is the fisherman *par excellence*.

—(S. & C.)

When travelling overland otters follow the smoothest course they can find, going round stumps and hummocks in preference to climbing over them. Travelling along the same course they soon establish a distinct path, crooked and tortuous, yet always proceeding in the same general direction.

"If seen and pursued by hunters on these journeys," according to Richardson, "the otter will throw itself forward on its belly and slide through the snow for several

yards, leaving a deep furrow behind it. This movement is repeated with so much rapidity that even a swift runner on snowshoes has much trouble in overtaking it. It also doubles on its track with much cunning and dives under the snow to elude its pursuers."

If too closely pressed, the otter will turn and defend itself with courage and power. Aided by protective armor, this short-legged animal is more than a match for a dog. The power of the otter's jaws is declared to be sufficient to crush a hound's leg bone and, maneuvering his antagonist toward water, the result is almost invariably a drowned dog.

At all ages otters are playful animals. They chase each other in games of tag and sport and roll in the water like porpoises. A favorite pastime has often been observed to be the pulling of opposite ends of a stick to see which is stronger. The otter slides have always aroused the admiration of observers. When a bank is sufficiently steep and slanting the otters make a roundabout path to the top of the bank and slide down the slippery surface into the water "like boys sliding downhill on the snow." As far as one good observer is aware, this is the only case among American quadrupeds where an entire race, young and old, unite to keep up an institution that is not connected in any way with the instincts of feeding, fighting, or multiplying, but is maintained as an amusement.

If caught young, otters are readily reared and become the most fascinating of pets. It has been my luck to meet with two or three tame otters, and in each case I was left with a profound admiration for the grace and playfulness of this exquisitely beautiful creature. On watching a gamboling fox cub, a fawn, an ocelot, a marten, or ever

a well-furred pet skunk, one is apt to be carried away and declare each in turn the most beautiful and graceful creature ever seen. But when all are gone from view, when nothing but the dim impression remains, it is the otter that stands out preëminently as the most beautiful and engaging of all elegant pets. There seems no end to its fun, its energy, its drollery, its good-nature, and its postures of new and surprising grace.

The handsome, durable fur causes this wild animal to be much sought for by hunters and trappers. Steel traps are commonly employed and occasionally the deadfalls of a hundred years ago. Advantage is taken of the otter slides. Having discovered a slide the hunter lurks in ambush and will often manage to shoot one or two before the tobogganers are able to get back to the safety of deep water. Trails discovered in the winter snow will often yield to chance shot. Everywhere man eagerly follows up otter signs and the gentle, beautiful, harmless creatures, never prolific, have come to be undeniably very scarce.

II. Weasel

A. New York Weasel *Putorius noveboracensis* (Emmons)
B. Short-tailed Weasel *Putorius cicognanii* (Bonaparte)
C. Least Weasel *Putorius rixosus* (Bangs)
D. Long-tailed Weasel *Putorius longicauda* (Bonaparte)

Length—A. 16 inches, female 13 inches.
B. 11 inches, female 9 inches.
C. 6 inches.
D. 18 inches, female 15 inches.

Description—New York Weasel. Tail always more than

one third the total length. Dark chocolate brown above, white on under parts, terminal third of the tail black. In winter pure white except the black of the tail, but this occurs only in the northern part of the range.—(S. & C.)

Bonaparte's Weasel. Smaller, difference in sizes of sexes not so striking, tail decidedly shorter, not much more than one quarter the total length. Dark brown above, tail tipped with black, belly and under parts white tinged with yellow. In winter pure white with a yellow tinge on the rump and tail black-tipped.
—(S. & C.)

Least Weasel. Smallest of the species with no black tip to the very short tail. Color, dark reddish brown above, white below. In winter white throughout.
—(S. & C.)

Long-tailed Weasel. All above pale, warm, yellowish brown (much like that of Bonaparte's weasel), darkest on crown and back, lightest on legs; all below rich, warm, buffy yellow; tip of tail for one quarter of length black. In winter pure white except the tail tip.

Range—The New York weasel is to be found in the eastern United States from New Hampshire to Virginia, and westward to Illinois. Bonaparte's weasel, the least weasel, and the long-tailed weasel are Northern and Western species. The long-tailed weasel is exclusively Western.—(S. & C.)

The weasels are very much alike in habit and there is probably as much difference to be observed in the ways of individuals of each species as there is between the different species.—(S. & C.)

No creature that lives is more thoroughly possessed of the lust for blood than the slim-bodied weasel. They hunt tirelessly, following their prey by scent, and kill for the mere joy of killing, often leaving their victims uneaten and hurrying on for more; sometimes they content themselves with merely sucking the warm blood. In eating a mouse, the weasel first sucks the blood through the large veins of the neck, then bites through the skull and eats the brains and, after that, if still hungry, he eats the flesh, turning back the skin and leaving it inside out with feet and tail attached.—(S. & C.) Owing to their slimness and elastic muscles they have a decided advantage over most small animals; rabbits, rats, squirrels, meadow mice, and many small ground-feeding birds fall easy prey.

The habit of these bloodthirsty creatures is to settle down on a good range, killing everything they can catch, travelling again only when opportunity for plunder is exhausted. The weasels are neither sociable nor gregarious: they are, indeed, "an unlovely lot" no matter how we look at them. Doctor Coues says:

"A glance at the physiognomy of the weasel would suffice to betray their character. The teeth are almost of the highest known raptorial character; the jaws are worked by enormous masses of muscles covering all the sides of the skull. The forehead is low and the nose is sharp; the eyes are small, penetrating, cunning, and glitter with an angry green light. There is something peculiar, moreover, in the way this fierce face surmounts a body extraordinarily wiry, lithe, and muscular. It ends in a remarkably long and slender neck, in such a way that it may be held at right angles with the axis of the latter. When the creature is glancing around, with the neck

stretched up and the flat triangular head bent forward, swaying from one side to the other, we catch the likeness in a moment—it is the image of a serpent."

Bachman tells of forty well-grown fowls having been killed in one night by a single ermine, and Kennicott that "in a single night and the early part of the following evening one of these [weasels] killed nearly fifty chickens, several of which were adults and many half-grown."

Weasels travel by gliding leaps, often covering several yards at a bound, their hind feet falling exactly in the front tracks. Their footprints in the snow are close together, in pairs, one foot slightly in advance, and the pairs separated by intervals of from one to ten feet or more. The weasel has remarkable courage and will face animals many times its size. Instances are even given of weasels turning on men who have interfered with their feasting. Whatever it does, it does quickly, which is doubtless one of the causes of its success. Though speed in the open is low, it is an adept dodger; in a tree, all testimony agrees, it is as much at home as a squirrel; in the water it is a good swimmer.

Who, then, are the enemies of the weasel? Why does it not multiply sufficiently to destroy every small bird, beast, and reptile in the country? Hawks, owls, and foxes undoubtedly dispose of some; more weasels are probably killed by weasels than by any other foe. Two weasels cannot live in the same thicket; one of them must fall or flee. An unusual increase in weasels results in such wholesale extermination of their prey that local famine awaits these bloodsuckers. In the fights for life that follow, the slightest difference in weight counts, and it appears that females are often overpowered and destroyed

by their unchivalrous lords, so that a ruthless check is put on the further multiplication of their race, and their number once more brought to its proper low adjustment. Sex probably counts for nothing among these weasels except in the breeding season.

Weasels growl, snarl, or utter a reiterated sharp sound in the larger species like a bark, in the smaller species like a shrill screech. Very little is known regarding mating habits. Probably mating occurs about the middle of March and the species pairs. The male does not trouble himself regarding wife or family after the mating season: at least, such is the prevailing opinion, though there is some testimony to the contrary.

Our information regarding the home life and the rearing of the young is not very satisfactory. The den is thought to be under stumps and in the hollow roots of old trees, possibly also in the burrows of ground-squirrels and woodchucks appropriated from owners which the weasels have killed. Gestation is presumably about forty days, as it is in the English stoat. The young, following the same analogy, are usually five or six and blind for some nine days after birth. Details are lacking, but it is assumed that the mother weasel lays aside her bloodthirsty instincts for a brief time until her young have acquired the age and strength to journey about with her and all too quickly to acquire a taste for warm blood.

Though with plenteous supplies and a predilection for warm blood the necessity hardly seems to exist, the habit of storing food is strong in the weasels. Kennicott credits the New York weasel with collecting in a particular spot a great pile of slaughtered rats and mice; Bachman instances an ermine caching a cottontail rabbit in the snow and

pressing the snow tightly down on it. Yet, though well-authenticated, the reason for storing food does not seem obvious.

The Latin word *Putorius* means "a stinker" and is applied with good reason to all the weasels. Merriam says, speaking of the long-tailed weasel, "I met one high up in Salmon River Mountains, September 5th; he was in pursuit of a Richardson squirrel in a damp, moss-covered place in a dark spruce forest, and stood bolt upright when he saw me. I wounded him with my auxiliary and he immediately emitted his powerful stench and disappeared in a hole at the root of a spruce." The insufferable smell of the weasels was undoubtedly developed as a medium of intercommunication; further development, particularly among the skunks and to a less degree among the weasels, has made the smell glands an effectual means of scattering enemies.

As has been mentioned in the description of the species, the weasels turn white on the approach of winter. The end of the tail remains black, however, and the black point, according to Stone and Cram, serves to catch your eye and hold it in spite of yourself, so that at a little distance it is very difficult to follow the outline of the rest of the animal. "Cover the tip of the tail with snow and you can see the rest of the weasel itself much more clearly; but as long as the black point is in sight, you see that, and that only. If a hawk or owl or any other of the larger hunters of the woodland were to give chase to a weasel and endeavor to pounce upon it, it would in all probability be the black tip of the tail it would see and strike at, while the weasel, darting ahead, would escape."

Yet with all their evil ways Kennicott is inclined to

think they should not be killed when living permanently about meadows on cultivated fields at a distance from poultry. Mice are undoubtedly the weasel's steady diet, and a granary overrun by these vermin will quickly become depopulated by the efforts of a single weasel.

This is one of the species that supply the famous ermine of commerce, but until very recently the fur did not have at the primary markets the high value that is generally associated with ermine. The value was so low that few trappers thought the animals worth skinning; but nowadays, when all fur values have trebled and quadrupled, fur of any weight, temporarily at least, is sure to command high prices.

III. Mink

Putorius vison (Schreber)

Length—21 inches.—(S. & C.)

Description—Larger than the weasel, with a thicker tail. Color always very dark brown, nearly black, with a spot of white on the chin and often on the chest or belly also.—(S. & C.)

Range—Northern parts of North America, south in the Alleghanies to Pennsylvania and probably to North Carolina. In the lowlands to Florida the minks belong to slightly different varieties.—(S. & C.)

Minks combine the habits of the land and water hunters more successfully, perhaps, than any other animal. They explore low lands and swamps where they feast on frogs and lizards and dig up grubs, beetles, and earthworms.—(S. & C.) On dry land they are inveterate nest robbers

and mousers. Nevertheless, it must be confessed that the mink is inferior to its cousin the otter as a fisherman, and on land has not the vigor or boldness of the long-tailed weasel.

As is the habit of the large weasel family the mink hunts a given area till game grows scarce, then moves on, quite likely not more than a few miles, in search of new hunting grounds. The mink always keeps within a well-defined area that it knows and considers its range. These individual ranges may overlap "like a number of rings thrown at random on the ground" and will be most numerous where food is most abundant.

As with many other of the wild animals, the mating habits are uncertain. Observers have seen minks in pairs, the male sharing in the family fortunes and helping provide for the young; there is also some evidence that the mink is polygamous, or even possibly polyandrous.

On the prairie Kennicott found the minks "living in burrows often six and eight rods in length, on high ground, from which long galleries extend to the edge of a slough or pond. These galleries, however, are not formed by the minks, but by muskrats which dig them in order to place their nests beyond the reach of high water and yet have subterranean communication with the stream." If the burrow be dug by the animal itself, it will be about four inches in diameter and may continue along for ten or twelve feet at a depth of two or three.

At the end of the long crooked tunnel is the nursery of the young. The male, however, has a den or dens scattered over the territory on which he ranges; to these he retires for slumber or to pass the time comfortably while inclement weather rages outside. The period of gestation

is generally agreed to be forty-two days. The young on arrival are about the size and shape of a little finger, pale in color, blind, naked, helpless. After about five weeks their eyes begin to open and their mother begins to supply them with solid food. The little ones continue with the mother till perhaps the middle of August. Then the family breaks up. The females attain full stature in ten months, the males not until a year and a half old.

The mink can hardly be called either diurnal or nocturnal. Mostly he retires, well fed after a long chase; when he wakes up, he yawns, stretches himself, starts forth again, indifferent to the time of day or night. In winter the minks chase rabbits over the snow, or, finding entrance beneath the ice of a closed brook, make extended excursions along the dim buried channel where they may chance on small fish, or meadow mice, or, in wider stretches of water, muskrats.—(S. & C.)

Small fish are perhaps the mink's preferred food and it delights in taking them by open pursuit in clear water. Frogs, tadpoles, mice, and muskrats are eagerly sought for. Or, when water animals are unavailable, the mink will run down rabbits, mice, and seek out the nests of birds. Stone and Cram write charmingly of a young female mink:

"Looking toward the sound, I saw, just for an instant, a beautiful young female mink with the sun full on her back, then saw only the russet-colored leaves sloping up between the tree trunks; but even while I looked there was the mink again several rods farther away and just in the act of vanishing as before.

"I squeaked like a mouse to call her, but the wind was so loud in the trees that I failed to make myself heard; so

I imitated the chatter of a red squirrel as closely as I could, and instantly the mink came skipping toward me over the ice of a little pond that lay between us.

"I do not think that I have ever seen any other four-footed creature, not even a deer or fox, run with such baffling swiftness. I could just catch the one image of her coming head up across the sunlit ice before she disappeared in the sere frozen water grass almost at my feet."

The mink in temperament is halfway between the docile otter, the gentlest of the family, and the sanguinary weasel. The mink (though with occasional weasel aberrations) is less likely to kill off an entire hen roost on his first visit: his customary proceeding will be to leisurely and systematically take a single fowl for his sustenance night after night until the supply be exhausted.

The mink bounds forward with high arched back. Speed is not great, but legs are tireless and morning may see the animal many miles away from the starting place. The cluck of a grouse, the rustle of a mouse, a promising odor in the wind, cause it to turn its course instantly. If surprised during its hunting or suddenly brought face to face with man, it often rises up on its hind quarters to get a better view.

When cornered and at bay the mink is the embodiment of savage ferocity. "One who has not taken a mink in a steel trap can scarcely form an idea of the terrible expression the animal's face assumes as the captor approaches. It has always struck me as the most nearly diabolical of anything in animal physiognomy. A sullen stare from the crouched motionless form gives way to a new look of surprise and fear accompanied with the most violent con-

tortion of the body, with renewed champings of the iron, till breathless with heaving flanks and open mouth dripping saliva, the animal settles again and watches with a look of concentrated hatred, mingled with impotent rage and frightful despair." (Doctor Coues.)

The combat of two minks, judging from the pictures of woodsmen who have been lucky enough to see the conflict, is a desperate affair ending in the death of one or the other. Sometimes both combatants stand off eyeing each other intently, "their small eyes like coals of fire." With mouth slightly open, their backs arched, necks stretched forward, hind legs close to the ground, they look much like "miniature tigers waiting an opportunity to spring toward each other." Quicker than the eye can follow, they spring forward, gripping each other by the throat with a grip that will mean death to the one that lets go his hold. They wind round and round till one or the other, staggering from the loss of blood, pulls his opponent down with him. The object of the mink in attack appears to be to grip the opponent so close to the lower jaw as to make certain that his opponent will not reach his throat.

All the weasel family have glands which give off a very offensive smell when the animal is excited. Merriam considers the stench of the mink to be even more unbearable than that of the skunk. "It is the most execrable smell with which my nostrils have as yet been offended, and is more powerful and offensive in some individuals than in others—the difference probably depending upon season and age. In one specimen the fetor was so intolerably rank and loathsome that I was unable to skin it at one sitting, and, I am free to confess, it is one of the few

substances of animal, vegetable, or mineral origin that have, on land or sea, rendered me aware of the abominable sensation called nausea."

Minks are easily trapped, especially if the trap be baited with the head and brains of some large bird. The old-fashioned deadfall trap is preferable both on grounds of humanity and practically, because it does not injure the fur. In steel traps, in which from lack of attention the mink has practically worried itself to death, the pelt has been usually found worthless.

The mink's fur is strong, beautiful, a trade staple obtaining always fair prices and, when the caprice of fashion decrees, prices that put it within the means of only the very wealthy. The mink breeds readily in captivity and several efforts have been made, for the details of which the curious are referred to larger manuals, to establish mink farms, where mink may be bred commercially. Undeniably furs of wild animals are scarce and growing scarcer; the theoretical solution seems to be along the line of producing the high-class furs by improving through selection the best animals obtainable; but except in isolated cases not much progress has been made as yet with farms of fur-bearing animals.

IV. Marten

Mustela americana (Turton)

(Called also *American Sable*, *Pine Marten*)

The genus *Mustela* (marten and fisher) is much like *Putorius*, but consists of larger animals, with bushier tails that are half as long as the body; large ears and arboreal habits; they do not turn white in winter.

Length—24 inches.—(S. & C.)

Description—The fisher is larger and heavier than the weasels and minks, with longer, bushier tail. The marten is smaller than the fisher with less bushy tail. Rich brown, somewhat lighter below, throat with a light tawny spot, ears high and pointed.—(S. & C.)

Range—The species ranges from ocean to ocean wherever there are heavy pine and fir forests, but is now becoming extremely scarce.

The marten is one of the animals that retired earliest before the advance of civilization. They exhibit less apprehensiveness at the sight of man than the otter, for instance, yet they seem always to refuse to inhabit forests anywhere near the contaminating hand of the invader. Martens love best overgrowth forests of gloomy fir: even broken woods will not do. Here they live amongst the trees like squirrels; or, skipping along the ground, follow up the scent of the hare.—(S. & C.)

Partridges, rabbits, squirrels are preferred, but the marten plays no favorites and kills all sorts of small birds and game indiscriminately. If the marten does not catch his hare on the first few leaps, he will be outdistanced; but he follows the scent along its crooked course, sure of success in the end. His feet are broad and well furred, which enables him to hunt in winter over soft snow where a mink or even a weasel would find himself sinking deeply.—(S. & C.)

There is little data available on the home range of this wild animal: probably, if food is to be had in any abundance, the range will be no more than a mile or two around the den. As to numbers, this fur bearer,

except in the far Northwest, has always been somewhat scarce.

Owing to migration, epidemic, starvation, or destruction by trappers, marked and as yet unexplained fluctuations have been noted in the marten population. The marten increases rapidly for a period of seven years or so until they are perhaps ten times as numerous as at the beginning of the period. Then they decline quickly and become very scarce. Some hunters and trappers consider that the marten migrates with the hare on which it lives. Modern science is more inclined to put the difference on the greater or less fertility of the female. Either the starvation of lean years or the overfeeding of seasons when rabbits are plentiful checks fertility and the efforts of trappers speedily reduce existing population.

The mating habits are quite unknown. The martens are so savage and unsociable that two adult animals probably never live together freely and amicably. Regarding the British marten, which has been bred in captivity, A. H. Cocks says: "All attempts at breeding were extremely hazardous: the allowing of a pair to run together was apt to result in the death of the female, in consequence of one or more of the long canines of the male penetrating her brain, the damage being inflicted so instantaneously that there was no possibility of a timely separation."

The nest is made by the female alone, in a hollow tree or burrowed into the ground. Here the young, three or four in number, are born in late April. The female probably suckles the young for a period of five weeks and they will require her care till at least the close of summer.

The marten is tireless in activity. In a cage it will race up and down to perch, to wall, to ground, over and over

again, sometimes all day long. It is the most arboreal of weasels, and, quick as is the squirrel, the marten commonly preys upon him. Gray squirrels are never to be found in marten territory. Practically the only chance for the little red squirrel is to reach a hole too small for his enemy to penetrate.

The marten remains always so cleverly in the shadow that many observers have supposed the species to be nocturnal. Probably this vigorous hunter moves about in the early morning and round dusk, occasionally prolonging activities into the night. The curiosity of the animal has been much commented upon. "Mr. Constable tells me that when a hunter discovers a marten climbing about among the tree tops," Merriam remarks, "he has only to whistle and the inquisitive animal will stop and peer down at him, affording an excellent shot."

The marten's diet comprises partridge, rabbits, squirrels, chipmunks, mice, shrews, birds, birds' eggs, fledglings, frogs, toads, fish, and insects of course; it also adds reptiles, nuts, berries, honey, and even carrion; mice are undoubtedly the most important.

What moss is to the reindeer, what grass is to the cattle, the mouse millions of the North are to all the Northern *Carnivores* from bear to blarina. When we shall have fully worked out the life history of each of these species I believe we shall learn that the whole of that vast, beautiful, important, and specialized production that we call the *Carnivora* rests on a broad simple basis of Muridae, that in turn rests on the grass, that rests on the earth. We shall for each of these flesh eaters write, "it sometimes eats this and sometimes eats that, but by far the greatest bulk of its food is mice."

The fisher and lynx are supposed to kill the marten in open fight. The marten population is probably kept down chiefly by foes "less dramatic and obvious," a parasite, or a disease, starvation, or perhaps a periodic non-fertility of the females.

Martens are easily trapped in old-fashioned pitfalls, in steel traps or, safest of all, in box traps set with large bait which insures the trapper finding the animal alive and getting the fur uninjured.

The marten's fur (American sable) has always commanded excellent prices in the markets and efforts have been made, but not so successfully as with the foxes, to establish marten farms. The animals are so murderously inclined amongst themselves that until slowly by selection gentler marten can be developed, the hazards will always be very great. As between the marten and the fox, the marten's pelt is worth nowhere near that of the silver fox; but the marten is in other ways easier to handle; martens get along with a tenth of the space, a quarter of the food and, if Russian sables (Siberian martens) can be obtained for stock, the returns for the small labor involved should be increased many fold.

From November to March the rich brown coat is thick and soft though sprinkled with coarse black hairs which are pulled out by the furrier. The fur is made into coats, caps, muffs, and boas, and commands about the same price as mink. Skunk fur is often treated and sold as marten. The average collection of furs of the Hudson's Bay Company for ten years, 1895–1905, was 63,926 of this species and during the eighty-five years, 1821–1905 inclusive, 7,006,554 skins.

V. Fisher

Mustela pennanti (Erxleben)

(Also called *Fisher Marten, Pekan, Blackcat*)

Length—3 feet.—(S. & C.)

Description—Larger and heavier than the weasels and minks, with longer and bushier tail. Grizzly grayish brown, lighter on the fore part of the body and darker brown posteriorly; tip of the tail black; darker also on the throat and legs; tail full and bushy.—(S. & C.)

Range—Boreal regions of eastern North America southward through the Alleghanies.—(S. & C.)

The fisher seen in natural surroundings suggests a big black cat with bushy tail, or else a black fox, according as it is seen in the trees or on the ground.

The fisher is by far the largest of the martens, with the strength of a wolverine and with more intelligence than a pine marten. Fishers have learned the trick of killing porcupines in spite of quills and in the Rockies have been known to circumvent she-bears and make way with the cubs. Gloomy hemlock and spruce-covered hills are the habitat of the fisher, and at times they cover immense distances in a night, travelling by bands, nose in the air, ready to follow up any likely scent.—(S. & C.) When they tire of the chase, they ascend trees as nimbly as the pine marten and catch partridges and smaller birds. Like that of their cousin, their regular fare is rabbits, which they are perfectly willing to vary with mice and whatever titbits may come to hand.

Fishers sleep all day in hollow trees or logs, preferring a cavity high up among the branches. In mild weather

they often take naps on the horizontal branches of fir trees, stretched out like a cat before a hearth.—(S. & C.)

The fact that the fisher does not burrow in the ground or habitually take refuge in holes is the weak point in its endowment. Living in the forest it must disappear as the forest disappears. Only those forest animals that are also underground species are able to hold their own against the axe of the pioneer.

The mating probably takes place about the first of March. The number is two to three usually, born about the first of May. The young are thought to quit the nest and follow the mother about as do the young martens.

Their vocal powers are considered to be fairly well developed. Bachman mentions a male that was treed, as "showing his teeth and growling at the same time . . . elevating his back in the manner of an angry cat," and another as "very spiteful, growling, snarling, spitting when approached, and emitting a rather strong musky odor."

The fisher is probably our most active arboreal animal. The quickness of a squirrel is known to everybody. But a marten can catch a squirrel, and a fisher can catch a marten, and there is no animal that can catch the fisher! In descending a tree it will often come down head first. There are several records of fishers leaping to the ground from a height of forty feet.

On the ground the fisher can run down rabbits and hares in open chase. If the animal could swim and dive well there would be little else that can be conceived of as desirable in the line of animal equipment.

The name fisher is not well applied. Fish the animal does not object to, having a wide catholicity of taste including eggs and fruit; but there is no record of its going

a-fishing. A most amazing proof of agility is its ability to catch and dispose of a marten. Audubon and Bachman tell of a fisher shot while up a tree in close pursuit of a marten.

Audubon also remarks regarding fishers treed in northern New York: "Whilst residing in the northern part of our native state thirty-five years ago (about 1814) the hunters were in the habit of bringing us two or three specimens of this marten in the course of a winter. They obtained them by following their tracks in the snow, when the animals had been out in quest of food on the previous night, thus tracing them to the hollow trees in which they were concealed, which they chopped down. They informed us that as a tree was falling the fisher would dart from the hollow, which was often fifty feet from the ground, and leap into the snow, when the dogs usually seized and killed them, although not without a hard struggle, as the fisher was infinitely more dangerous to their hounds than either the gray or red fox."

On the ground the fisher travels by a succession of square-tracked jumps, somewhat like those of the marten but proportionately larger. In chasing white hares the fisher may stalk them cat fashion or run them down as do the dogs. While the rabbit circles, the crafty fisher is always careful to pursue well inside the circle; presently, the circle constantly narrowing, he is able to cut across and make short work of the exhausted hare.

Fishers have well-developed storage habits. Probably food is not stored for more than a day or two, though there is some testimony of large supplies cached for winter consumption.

Fishers kill porcupines as do bears by turning them over

on their backs and biting them on the defenseless stomach. They then cut out the meat, leaving the quilled skin almost entire. The dissected bodies of fishers show many quills imbedded in various muscles, but there is little evidence that they are ever fatal to the fisher as they certainly are to most animals that try a hazard of fortunes with the porcupine.

The fisher is one of the very wildest of wild animals. Stone and Cram believe that hardly another suffers so much from being caged. "Of all those that I have seen imprisoned, not even the pine marten or lynxes looked at me with such hopeless despair as the fisher, and I earnestly hope that I may never have to see another in a cage. There is cruelty enough in the woods, heaven knows; but the trapper who sets his steel trap with a spring pole that jerks the game into the air and keeps it hanging by a leg through long days and nights in all weathers is merciful by contrast with him who can be hired to catch a full-grown fisher uninjured in order that it may drag out a wasted life in prison for no fault of its own."

The Hudson's Bay Company's records show 377,338 skins of this species collected over a period of eighty-five years from 1821 to 1905 inclusive, an average of no more than 4,439 a year as compared with a yearly average of 82,418 for the pine marten.

VI. Wolverine

Gulo luscus (Linnaeus)

(Called also *Glutton*, *Carcajou*, *Skunk Bear*)

Length—30 inches.—(S. & C.)

Description—Heavy and bear-like, walking on the sole of the foot. Hair long and shaggy; general color blackish

brown, lighter on top and sides of the head; feet black, a pale yellowish-white band from the middle of the body on each side widening out on the flanks and joining over the basal portion of the tail.—(S. & C.)

Range—Boreal North America, northern New York (formerly) northward.—(S. & C.)

The woods from the St. Lawrence and the Great Lakes northward to the limit where trees no longer can live are the home of this unlovely brute whose habits are such that one of his common names is glutton. The wolverine has developed shrewdness and strength at the expense of agility. No longer able to run down a hare in open chase or climb a tree for a squirrel, he robs fur-coated fellow hunters and red men or white of gathered stores.—(S. & C.)

Probably what he can steal must sustain him through the winter. For mice and squirrels and the like are seldom available and swifter animals than he are always on the prowl. In the spring and summer young birds and eggs of various sorts are eagerly sought and quickly gobbled down. The wolverine has been known to dig out a fox den and make away with the young cubs if he be so lucky as to find them.

As with most of these fur-bearing animals, our knowledge of mating habits and the care of the young is chiefly based on inference and analogy. Probably the species pairs, and gestation is supposed to last about sixty days. The site chosen for the nursery is likely to be almost any sheltered hollow in the ground or under rocks; only occasionally does a wolverine go to the trouble of digging out a hole herself.

The young number two and three, more rarely four and

five. They are suckled eight or nine weeks and fed at home till quite late in the summer. They are full grown in about a year. All accounts agree that the she-wolverine, when with her young, is absolutely fearless and so strong and quick that even an armed man is taking risks to approach her.

All Northern traders grow eloquent over the cunning and almost diabolic propensity for mischief of the wolverine. "The hunter," declares Lockhart, "may safely leave an animal he has killed for one night, but never for a second time, without placing it in a strong cache of logs. The first night the wolverine is pretty sure to visit the place but will touch nothing. The next night he is certain to return, and if he can possibly get at the meat, he will gorge himself and then make away with the rest which he cunningly hides, piece by piece, under the snow in different directions." Ross remarks that "the animal does not appear to care much what it steals, so that it can exercise its favorite propensity to commit mischief," instancing a trapper who left his lodge unguarded and returned to find a wolverine had made off with blankets, guns, kettles, axes, every bit of paraphernalia that the trapper possessed. Hearne tells of a wolverine that dug through a huge pile of wood to find small parcels that had fallen down into the bottom of the pile. "The bags of flour, oatmeal, and peas, though of no use to him, he tore all to pieces and scattered the contents about on the snow; but every bit of animal food, consisting of beef, pork, bacon, venison, salt geese, partridges, etc., to a considerable amount, he carried away."

Yet the early stories of the prowess of the wolverine are far from the truth. The wolverine probably never

climbs a tree in order to drop down on passing deer. It was also supposed to be "the great enemy" of the beavers, but all the modern evidence available is to the effect that, while the wolverine swims, it is not greatly at home in the water.

The strong musky odor present in all the weasel family is very strong in the wolverine. The wolverine rarely retreats before a foe with four legs, and when in possession of quarry from which he fears to be disturbed, will occasionally stand up against man. Wolverines have been reported to have forced a gray wolf to retire before stuffing himself on a deer that the wolf had but just killed.

John Richardson in his account of the Arctic Exploring Expedition (1851) bears early witness to what have been commonly agreed to be the characteristics of the animal. "The wolverine," he says (we must somewhat condense the account), "is extremely wary and shows extraordinary sagacity and perseverance in accomplishing its ends. The Indians believe that it is inspired with the spirit of mischief and endowed with preternatural powers. With teeth that do not seem to be peculiarly fitted for cutting wood, it will sever a log equal to a man's thigh in thickness by constant gnawing. The animal works so hard in carrying on this operation that it causes its mouth to bleed, as the ends of the logs and the snow often testify. Once admitted into the hoard, it has to gnaw the pieces of meat asunder, as they are generally frozen together, and then it proceeds to drag them out one by one, and to bury them in the snow, each in a separate place. As it travels backward and forward over the meat, it smears it with a peculiarly fetid glandular secretion after which no other animal will touch it. In this way one of these

beasts will spoil a large cache in an hour or two and wholly empty it in a few nights."

Various tricks have been evolved to keep provisions or stores safe from tampering by wolverines. Indians are said to have arranged furs from a bough with dog sleigh bells, so that, as the wolverine crawled along the branch, the bells would tinkle and frighten the animal away. Provisions frozen into the ice are, of course, safe, and there is always the possibility of using strychnine. Strychnine is considered to ruin the fur of the animal poisoned; also, one strychnine bait may claim many victims, tending to ruin much trapping. Yet it is all too frequently employed, as trapping by ordinary methods is likely to be very tedious. The wolverine is slyer even than a fox when it comes to springing a trap without harm to himself. The most successful method seems to be to bury both trap and bait deep in the snow.

This greedy animal is thoroughly hated by Indian and white alike, and his capture gives greater satisfaction than the value of his fur alone would ever warrant. Skunk-bear well describes the appearance of the fur. The size is that of a small bear, the quality somewhat the same, and the two paler bands spreading from the nape of the neck along the sides to unite again in the bushy, skunk-like tail, seem to complete the picture.

The Hudson's Bay Company's records show 101,426 skins, or an average of 1,192 a year for the eighty-five-year period from 1821 to 1905.

VII. Skunk

Mephitis putida (Cuvier)

The true skunks belong to the weasel family (*Mustelidae*) and to the digger or badger sub-division of the group

(*Melinae*). They form the genus *Mephitis* and are about the size of the common house cat. They have short ears, long fur, very large and bushy tails, are black in color, with a thin white stripe on the face and a broad one beginning on the nape, forking on the shoulders to reach to the hind-quarters, or sometimes nearly to the tip of the tail. They are at least partly plantigrade, and have the fore claws very large and suited for digging; as a special characteristic they have greatly developed glands which produce the liquid musk that they eject with such notable effect in self-defence.

Length—2 feet.—(S. & C.)

Description—Body covered with long hair, tail very large and bushy; color black with a white patch on the back of the neck from which two stripes extend down the back and along the sides of the tail, and a white stripe down the forehead. Sometimes the white is almost restricted to the patch in the neck and in the other specimens the stripes are united, making the whole back white.—(S. & C.)

Range—New England to Virginia and Indiana. The Northern Plains skunk (*M. hudsonica*) is much larger, and the Puget Sound skunk (*M. occidentalis spissigrada*), also with longer tail and with well-marked cranial characters.—(S. & C.)

The almost suffocating odor which the skunk has developed as a means of repelling enemies has been so successful as to have a very marked effect on the skunk race. The skunk still retains much of the slender and graceful form of the weasels, but inaction has caused its

muscles to become soft and tender and its body to become burdened with a load of fat. By the last of October, after the lush autumn season, the skunks roll and totter about on their weasel feet that seem much too small to support an animal of so much weight and dignity.

On the open prairie, along the edges of woods and marshes, wherever there is sunlight mingled with some cover, skunks are to be found. Not being forced to travel any great distance in search of food, this wild animal may pass a lifetime within a radius of no more than half a mile. Statistics are not available, but the skunks are easily amongst the most abundant of the remaining Carnivora in many sections of the countrv. As they appear but seldom in the daytime, they are not given credit for their actual numbers. In the evening, particularly in warm weather, it is more common to see them moving leisurely about, occupied doubtless in the important business of procuring an evening meal.

The monstrous bushy tail and the black and white pattern are recognition marks that are well known to the skunk's wild neighbors. Day or night they notify all the world, "I am a skunk; no one can hurt me with impunity." The wild folk do not fail to profit by this blazonment and the skunk is saved a deal of unprofitable exertion.

The skunk is likely to select a dry place on a hillside for a habitation but is quite willing to use the abandoned burrow of badger or muskrat, or to hollow out the den of a ground-squirrel to suitable dimensions. Most hunters believe the animal to be monogamous. They mate from the first to the middle of March and the young are born about the end of April or early in May. At birth the four or six skunklets that usually compose a litter

are about the size of a mouse, naked, yet showing plainly the black-and-white markings of the adult. About midsummer they begin to follow their mother abroad "like a litter of little pigs after the old sow." By October the young might pass for adults. The actual break-up of the family occurs in the spring, the immediate cause being, as often, the rearoused mating instinct of the mother. The young are now fully grown. Possibly they themselves breed the first year.

It is curious that young skunks no bigger than half-grown rats will, at once, when frightened, go through the attitude of defence, prepare to repel the enemy with the skunk's weapon, the musk. The young skunks must attain a growth of about three months, however, before sufficient musk will be secreted to make them dangerous.

Every country boy knows the odor of the skunk. Those who have never smelt it may realize some of its power if they imagine a mixture of perfume musk, essence of garlic, burning sulphur and sewer gas, intensified a thousand times. "The secretion is a clear limpid fluid of amber or golden yellow color, has an intensely acid reaction, and in the evening is slightly luminous." (Merriam.)

The musk is secreted by two glands under the tail. The skunk invariably gives fair notice of his intentions: the first by facing about and stamping; the second by raising and spreading the tail, all but the tip which hangs downward; the third and last when the tip rises up and spreads out. The spray is thrown a distance of usually four to six feet, occasionally ten. The skunk rarely fires straight backward. Its gun can be trained in any direction or at any

elevation, but it prefers to aim at a foe that it can clearly see.

And woe to the unhappy creature that is made the target of this battery! If it reaches his eyes, it may cause blindness, at least for a time; in his nostrils it acts as a choking irritant. The smell alone is powerful enough to upset most stomachs, and in some cases causes convulsions, fainting, and even death. Certain individuals are much less powerfully affected than others, but, as a rule, men, dogs, and wild creatures with one accord prefer to let the skunk alone.

A bold attack may result in the capture of young skunks, but few amateurs will probably care to attempt it. Two men in my employ called my attention to an old skunk and two well-grown young ones that were walking across a field. I told the men to do as I did, then took a stout board and ran after one of the smellers. He ambled off, but, finding me close on him, he faced about and made ready for action. I approached, holding the board in front of me. When I was seven or eight feet away he fired over his own head. I jumped and the shower reached the spot whereon I had stood. Before he could get another charge ready I rushed at him, pushed his tail down, with the board laid on his back, then, slipping a hand under each end, I caught him by the neck and tail, and carried him in triumph to a box. The men tried to do the same, but both got badly skunked, especially the one who attacked the mother. She made good her escape but the other young one was put in a box with his brother. This adventure cost me two suits of clothes.

Young skunks make attractive, gentle pets, manifesting considerable affection for those who take care of them.

It is possible to remove the scent bags by operation, but this is not commonly done. Skunks can bite when necessary and have occasionally transmitted hydrophobia. When they fight among themselves they are said to observe an unwritten law to refrain from using the musk.

Grasshoppers, crickets, insects, meadow mice are staple skunk food. The animal has lost its speed, its ability to climb a tree, its keen wits. As it can no longer run down hares or chase squirrels, it has been forced to take up an insectivorous diet. In February a skunk is hardly recognized as the heavy-bodied sluggard of autumn. During still cold nights they no longer sleep, but shuffle about often from sunset to sunrise. Insects are not obtainable; perhaps the best hope they have is to surprise a rabbit in his hole.

As the season advances, prospects brighten. Meadow mice begin to appear and small snakes driven from winter retreats by melting snow. By May the bad season is over: birds' nests are searched; there is an increasing supply of bugs and reptiles; the skunk is able slowly to take on a little weight.

This stupid animal can be easily captured in the most obvious of traps. A trapped animal is best despatched by one sharp heavy blow across the back. Muscles below the point of injury will then be paralyzed and no musk can be vented. When caught in a box trap, box and all may be sunk in water, as a drowned skunk rarely smells.

The horned owl manages to make away with quite a few skunks, but all quadrupeds, save in desperation, leave the animal alone. The owl has the advantage of being able to swoop down from above, seizing his prey by neck and loins. The skunk cannot reach its opponent but is able

to make the neighborhood reek with repellent odor. The fact of its smelling strong of skunk does not by any means prove that the owl has dined off skunk.

All the northern species are standard fur bearers. The skunk is one of the most valuable fur-producing animals in North America. Skunk farms are maintained in Canada and precise directions are available in several pamphlets as to how to become a skunk farmer.

VIII. American Badger

Taxidea taxus (Schreber)

The genus *Taxidea* comprises large animals of the weasel family (*Mustelidae*). They have thick, heavy bodies, very short tails, short legs, front feet immensely powerful, with long claws developed for digging; ears very short.

Length—27 inches.—(S. & C.)

Description—Body rather thickset and flat; feet rather short; claws on fore feet very large; tail short. Grayish, mottled with black on the back in irregular transverse bands; tail gray; lower parts dirty white; center of face black, including the eyes and region just above them; a white median stripe from the nape nearly to the snout; sides of face and throat white; a large black patch in front of each ear. Legs and feet black. —(S. & C.)

Range—Western United States east to Wisconsin and Texas, north to Saskatchewan and Manitoba.—(S. & C.)

The European badger seems to live much like a skunk, trotting about at night, above ground, seeking its food in the woods and thickets. Our American badger is a very

timid, gentle, burrowing animal that feeds chiefly on such humble folk as field mice and ground-squirrels. Yet his skin is equally tough and his jaws possessed of the same relentless grip as his European cousin. The badger is so strong that a man cannot pull it out of its hole if once it gets fairly braced. Also the skin is so loose that a bulldog may hold the animal by the scruff of the neck without in the least shutting off the badger's wind.

Dry rolling prairies well populated by ground-squirrels are the badger's favored surroundings. This is a strictly prairie animal and is likely to disappear when all the open country comes into cultivation.

This small animal has bartered speed for strength to dig. It is probable that each badger makes a burrow every twenty-four hours during the summer in search of food. The male badger has quite likely no one den to which he regularly returns. The female cannot arrange affairs in such easy fashion. Early in the spring she prepares a complete nest of grass in a well-drained hole, two or three feet below the surface. Here in late May or early June the young badgers are born.

If a badger happens to be caught at a distance from his hole, he seldom makes a run for it, preferring to flatten himself down "like a doormat, or a turtle." His long silky gray hair, parted in the middle down his spine, spreads out into the grass; he blends so well with hummocks that often the most keen sighted will pass without suspecting his presence. Even in a cage he tries the same trick so successfully that most of the passers-by fancy the cage to be empty.—(S. & C.)

Deep underground the badger is safe from violence. It is hopeless to attempt to dig him out, but a couple of

buckets of water will shut off wind and usually force him to the surface. The story is told of a badger who managed to swell out his body so that the hole was effectually plugged and no water could reach his head. Not until a spade handle was pushed between him and the wall, letting through the water with a rush, did Mr. Badger yield in the unequal struggle.

Perhaps he has not been observed as closely; in any event, testimony does not give the American badger the social customs and frolicsome tricks that are attributed to the British species. Particularly, nothing has been reported of social games such as the "King of the Castle," when the members of the family repair to a low stump or trunk and there play a game of trying to climb up, or to pull each other down.

In England, according to Sir Alfred E. Pease, much sociability is reported amongst badgers. "Nor do the married pair shun the society of their kind. I have often seen large badger 'sets' almost as full of badgers as a warren is of rabbits. One evening near my house I waited an hour of midge-plagued time to watch the badgers come out from a small set and was rewarded by seeing a procession of seven full-grown badgers emerge from a single hole and I had them all in view for something like twenty minutes. As this was in July, they could hardly be one family."

The badger is a winter sleeper, one of the "seven sleepers," the country folk say. He generally appears above ground after the snow disappears, remarkably little thinned by his long torpor. In the early days of Manitoba the traveller would see, hourly, on sunny mornings, "a whitish bump on a raised mound of earth" that

would presently disappear, showing the bump to be simply a badger taking his morning bath.

Curious partnerships have been instanced from time to time among the wild animals. Badgers have been reported living happily with foxes in both England and America, and we have the even more curious partnership of a badger and coyote recorded by A. H. Hawkins, a Canadian government surveyor. The two animals travelled in company, the coyote ahead, the badger following as close on his heels as was possible. I would conjecture that the partnership was involuntary on the part of the badger. The coyote understood, no doubt, that the badger would dig out ground-squirrels, some of which would bolt and give the partner a chance to share in the spoils.

The only sin that can be charged against this wild animal is that badger holes endanger the limbs of stock and lives of horsemen. On the whole, the badger must be considered a valuable animal even as the gopher is considered a nuisance.

The pelt is a good silver gray, strong and durable. The total catch of badgers for fur, including the Hudson's Bay Company and other American companies and averaging over a long period of years, will be about 7,000 a year.

VI

RACCOONS

Family *Procyonidae*

Small or medium-sized bear-like animals, many tropical, but represented in North America by the raccoon and in the West also by the bassaris and coati. All these may be recognized by their black- and white-ringed tails.
—(S. & C.)

Raccoon

Procyon lotor (Linnaeus)

(Also called *Coon*)

Length—32 inches.—(S. & C.)

Description—Form stout, tail thick, snout pointed, long hair, rather coarse. General color gray or yellowish at base of hair, dusky or black at tips; dark on the back; face whitish, with a black area on each cheek surrounding the eye; feet black; tail very bushy, grayish white, strongly ringed with black.—(S. & C.)

Range—Eastern United States to the Rocky Mountains, replaced in Florida by the Florida raccoon, *P. lotor elucus* Bangs, a gaunter animal more yellow in color. Other varieties occur westward.—(S. & C.)

As compared with the majority of the woodland dwellers, the raccoon is of clumsy, deliberate movement; he requires large space, hollow trees, or a good-sized cavern

for a home; he is persecuted vigorously at all seasons by men and dogs; yet, strangely enough, and in marked contrast to others of the original settlers, the raccoon seems generally to be holding his own, in some districts to be even increasing in numbers.—(S. & C.)

The coon is a denizen of woodland edges, preferably hardwood. As hollow trees are favorite lodges, the coon will never be found in dense coniferous forests. It is a common thing to find a half-dozen animals in one tree; but they do not run in bands except as families; nor are several nests placed together. The den is the year-round home of the family but, like many other species, the raccoon is quite likely to have hunting lodges near remote feeding grounds to which he can repair when it seems desirable.

Naturalists generally agree that the raccoon is monogamous and that the male helps to some extent in the rearing of the brood. The time of mating is not certainly known, but is probably in the autumn. The young are born in April or May, four being the usual number. At first they are nourished only on milk. By late June they are a third grown and begin to sit outside the den on bright days. The home life is thought to be nearly ideal. By August the mother coon leads the youngsters to the fields of green corn in which they revel as only coons can. Probably the young stay on with their parents through the winter and until the family quarters are needed for the additions to the family which will arrive in the spring.

Raccoons have much in common with bears and shuffle about the woods in quite a bear-like manner, making a meal of whatever comes to hand. The fruits of the season, nuts, cherries, wild grapes, and blackberries, are all accept-

able; bugs and small reptiles are eagerly devoured; they will even lie in wait on the edge of water and hook out fish that may come within reach.—(S. & C.)

These night wanderers often surprise sleeping birds and young squirrels, in the hope and anticipation of which they will travel long distances along the tree-tops. The coon's curiosity is proverbial. A piece of tin or other shining metal is often hung over a trap to attract his attention, and it is said he will sit for hours striking the shining metal with his paws in order to make it whirl and spin about. —(S. & C.)

Robbing hen roosts is perhaps the coon's most serious offense. A coon in a henhouse appears to lose all discretion, killing right and left and then gorging himself on the results of his carnage. A coon does not understand the tactics of the fox, who never returns a second night to the same treasure-trove. As a result the raccoon is far more likely to suffer the extreme penalty of his tastes than is Reynard.—(S. & C.)

The Latin title *lotor* has reference to the curious washing habits of this animal. The coon washes all meat before eating and, in domesticity at least, has been observed to go hungry rather than eat food which it did not have opportunity to cleanse. The raccoon is a great grubber in the mud for frogs, and a reasonable suggestion seems to be that they have thereby acquired the habit of washing food. Quarry obtained along muddy bottoms must first be cleared of sand and clay before eating could be a real satisfaction.

Frogs are thought by many observers to be the summer-long main support of raccoons. Merriam notes that raccoons overturn stones and catch crayfish and fresh-

water mussels. Pennant declares the animal to be particularly fond of oysters and that it "will watch the opening of the shell, dexterously put in its paw, and tear out the contents; sometimes the oyster suddenly closes, catches the thief, and detains it till drowned by the return of the tide." In the Southern States Audubon and Bachman mention that the raccoon will watch the soft-shelled turtle when she is about to deposit her eggs and, noting the spot, will quickly dig them up notwithstanding the efforts of the luckless turtle to conceal them.

Young raccoons, if taken at an early age, are easily tamed and show considerable affection for their masters. They have, however, an innate propensity for mischief that makes it desirable not to allow them too much liberty. They manifest insatiate curiosity to investigate edibles on pantry shelves, removing covers from jars and pails and uncorking bottles with ease and facility. Forepaws are employed as hands for purposes of investigation and after a pet raccoon has made an examination of a room it will be found that very little has escaped his attention.

Half a million raccoon skins have been shipped out of the Far North in good seasons to be manufactured into overcoats, sleigh robes, and motor apparel. The fur is of good grade though somewhat coarse, and, until recently, abundance has kept the price low.

In the South the coon has long held fame and popularity scarcely equalled by any other wild animal. The white children on the Southern plantations obtained most of their knowledge of natural history from the slaves, profiting by the "peculiar mixture of insight and imagination with which the Negro observes the wild things about him." Though they received many quaint ideas and superstitions

blended with their fact, Stone and Cram believe, and many will agree with them, that the Southern children "got an appreciation of the true inner selves of the little beasts not to be obtained from books or any amount of scientific research of the trained naturalists."

VII

BEARS

Family *Ursidae*

The Bear family, *Ursidae*, is composed of very large, heavy, thickset, carnivorous animals of dull colors, not spotted or striped. They have five well-developed toes on each foot; hind feet are plantigrade; claws fixed; very short tails; short rounded ears, and the true molars with broad, flat tuberculated crown.

I. Grizzly Bear

Ursus horribilis (Ord.)

(Also called *Silver Tip, Montana Grizzly*)

Length—6 feet 6 inches.—(S. & C.)

Description—Fur shaggy, especially long on the shoulders and flanks; front claws much longer than the hind ones and strongly curved; hind feet relatively longer than in the black bear. Brownish yellow; darker on the back and legs; long hair, often reddish brown.—(S. & C.)

Weight—The heaviest authentic weight is 1,153 pounds. 600 pounds will be the average weight of males and 500 pounds of females. Guesses at the weight of grizzly bears have been usually absurdly high.

Range—Rocky Mountains of Utah to Alaska. Closely related varieties occur in the southern Rockies and at Norton Sound, Alaska.—(S. & C.)

In the old days this heavy lumbering brute regularly hunted the bison in the foothills of the Rockies and is said to have been able to kill and drag away an old bull of a thousand pounds weight. Nowadays, though he occasionally attacks cattle, the grizzly bear lives mostly on very humble fare: mice, insects, berries, fruits, and the green growth of the meadows.—(S. & C.)

Distinctive externals are a concave facial outline (the black bear's is nearly straight), the maned hump on the back, over the shoulders, and the great size of front claws which are twice the length of the hind ones and but little curved.

Even in the days when bears roamed the wide plains they were more likely to be found in bottom lands than in the open. Grizzlies desire the combination of open spaces varied with cover. In such surroundings food should be available in abundance; open spaces are utilized for sunning and the cover for the hot season; if water for wallowing can be added, the situation will be ideal.

What little we know regarding the mating of these large animals has been derived from those observed in a state of captivity. Grizzlies mate in midsummer; the period of gestation is about six months. It is probable that the grizzly breeds but once in two years unless the young are destroyed before midsummer. The cubs do not shift for themselves to any extent before the second year and probably do not breed before the third.

I made notes on cubs born in the Golden Gate Park at San Francisco. On December 23d (six months and four days later) two little cubs were born in the cage. They were kept hidden by the mother for several weeks. They are now (March 18th) nearly three months old and about

a foot high at the shoulder. They weigh, I should think, twelve or fifteen pounds, are very pretty and playful. Their ground color is gray, with dark ears, feet, and patch around eyes. Already they eat meat, fruit, bread, etc. Their mother is very careful of them. She seemed unwilling to let them go out of the den, but they got past her and she followed. As we fed them, it came on to rain very heavily and suddenly: at the same time a loud slam of the bars alarmed her. At once she called and cuffed the two young ones under her body; then straddling very wide, sheltered them from the rain and guided them back to the den. Sometimes the little ones put their paws through the cage to their father. He would sniff at the paws very loudly and utter a sort of short, quick *koff*, *koff*, *koff*, *koff*. It was not a menace, as he offered them no harm, though he had ample opportunity.

When a grizzly has established a hunting range for himself, he writes his challenge with his claws on the trunk of a pine as high as he can reach. Another bear, happening along the path, will be sure to see the warning claw marks and, rising on his hind feet, he also strikes the bark in a similar manner. If he fails to scar the trunk as high as his predecessor, he will move on, giving up any casual thoughts of lingering or settling in this vicinity. If his mark on the tree be higher and, if the grazing suits him, he will quite likely linger about. Possibly the first comer will then abandon the location; or there may be a battle royal. Many of the denizens of the wild are accustomed to challenge all comers in this fashion and, no doubt, careful examination of relative markings leads many a pugnacious individual to decide that discretion is the better part of valor.—(S. & C.)

The grizzly is omnivorous in food habit. In the open a diet of prairie turnips will be usually varied with occasional ground-squirrels and gophers. Their great muscular strength enables grizzlies that grow more carnivorous than others to master the range steer, and at times they have become nuisances on cattle ranges in their vicinity.

For fifty or one hundred yards the grizzly can go as fast as a horse. It is well known that Indian ponies that have been wintered out and are not in the best of shape have been pulled down in the spring by grizzlies on the open plain.

The mentality of the grizzly is far below that of dog or wolf. Of superb muscular vigor, with powers of scent as keen as any and ability to travel fast, this powerful animal has learned the danger of rashness and now arranges its life on safer lines.

In early days, as the accounts of travellers from Lewis and Clark down all agree, the bear had little fear of man. It can and will fight with wounds in all non-vital parts; and vitals are well protected. The Indian with bow and arrow, or even with musket and flintlock, had very little chance of success against a grizzly. Hiawatha, in Longfellow's poem, went to the Far West and returned with the claw necklace of the grizzly Mishe-mokwa, and among the red men the possession of evidence of having killed one of these big brutes in personal conflict was at all times a proof of valor extraordinary.

In modern days the grizzly has changed greatly in temper as in life and the faintest whiff of man scent is sufficient to drive him miles away. Repeating rifles have eventually instilled in the wild the understanding that man is master and that in man's presence safety lies only in retreat to

wild and inaccessible regions of thicket and swamp. The fallen monarch has become a fugitive in his own kingdom, or lives as a pensioner in the Yellowstone Park. A movement to prevent the extinction of the grizzly bear would be timely; bounty laws might well be repealed, for well does he know that his day of power is gone; and certainly the extinction of this magnificent animal would be as great a loss to the world of zoölogy as the destruction of St. Peter's would be to the world of art.

II. Black Bear

Ursus americanus (Pallas)

(Also called *Cinnamon Bear*)

Length—5 feet.—(S. & C.)

Description—Entirely black, with a brownish tinge on the face. Some individuals are uniform dark chestnut, or cinnamon, with purplish reflections in certain lights, and are called "Cinnamon Bears." For many years this color phase was thought to represent a distinct species.—(S. & C.)

Weight—200 pounds may be considered medium-sized and 300 pounds top weight for the Northern black bear. The Florida variety attains greater size and weights have been reported up to 512 pounds.

Range—Forest regions of North America, except the Gulf States and Labrador where allied varieties occur. —(S. & C.)

The rough shaggy bear of folklore and storybooks that roars and attacks men on sight is the brown bear of Europe. Our black bear is smooth-coated, well-shaped, timid,

inoffensive, though savage and brave enough when attacked, or in defence of its cubs.—(S. & C.)

The black bear, once roaming practically all the wooded regions of the continent, is still to be seen occasionally in lonely regions where there is thick timber and rough land. The typical form and nine variations are recognized.

On none of the wild animals is it more difficult to form an estimate of those existing now or in primitive times. The annual average number of skins exported during the last quarter century from all sources is about 14,000 over an area of about 5,000,000 square miles. Making all allowances, there exist at present perhaps 300,000 bears, one to every sixteen square miles appropriate to their life.

The individual is a wide ranger and there are some reports available showing general migrations of the species. Where bears abound, the whole country will be found to be laid out in trails. In passing over these trails the bears step in each other's footprints, never deviating from the exact line if it is in any way possible to avoid doing so. A bear trail is deficient in head room for man; it will be found to run along a log, if occasion arises, and to cross a stream by a log rather than a ford. Campers will find that, if they are in search of the things for which the bears are also in search, berries, fish, water, or pleasant hillsides, they will find them along bear trails; but experimenters should always remember that where there is a bear trail, there may also be a bear trap.

The habit that bears have of biting and scratching the bark of trees along their trails has been noted by many hunters and observers. "In traversing unfrequented

portions of the (Adirondack) wilderness," says Merriam, "one occasionally meets with a tree whose bark has been scratched and torn at some little height from the ground, in a manner that cannot fail to excite his attention and surprise. This is the work of the bear, but the object of it is not known. Hunters claim that whenever a bear passes one of these trees he stops, stands on his hind legs, and gnaws and scratches it before resuming his journey." "Bears bite trees all summer," writes L. Allen in *Recreation Magazine*. "Only he-bears bite trees. They bite them along their roads and the one that makes the tallest marks bosses the road. After you kill the big one you don't see another he-bear for a long time on that road. She-bears pass any time."

Grizzly and black bears are easily to be distinguished, the claw marks of the grizzly being clearly five, and again by their sizes being larger. The black bear's claws usually leave only four marks. If an aspen is used, as it often is in the Rockies, the scars never leave the smooth bark, which thus becomes the depository of many records. There can be little doubt that these bear signboards are employed as mediums of communication. A creature of the sensitiveness of the bear reads at once, by touch and taint on the register trunk, the character of the previous visitor and the length of time that has elapsed since he or she passed.

Nine out of ten grown bears of this species will be found leading solitary lives. The mating occurs in the latitude of the Northern States and southern Canada in early June. Little is known in detail and, after the mating season, the bears go their separate ways.

The period of gestation is about seven months. The

young at birth are astonishingly small (about 8 inches) and of light weight (9–12 ounces). This will be no more than $\frac{1}{200}$ to $\frac{1}{250}$ of the mother's weight, while a young deer is $\frac{1}{80}$, a young dog $\frac{1}{25}$, and a young porcupine $\frac{1}{15}$. The cubs are usually two in number, three being fairly common and four being recorded but rarely.

At birth the cub is blind and covered with fine, close, dark hair. In cases observed in captivity, the she-bear hovers over them with great care and their first efforts to move about are restrained by vigorous cuffs. The gambols of young bears are very amusing and have been described by many admiring commentators. We quote from an account by Frank J. Thompson of black bears in the Cincinnati Zoo. "They soon became expert climbers, taking advantage of the slightest inequalities of the stone walls and the cracks between the heavy oaken planks to reach the ceiling of the den on three sides, while the grating in front served capitally for their skylarking. Occasionally they would have a regular sparring bout, standing erect, feinting, countering, and making use of many of the tricks of old votaries of the prize ring. These frolics would generally end in a clinch fall and a regular rough-and-tumble fight, when the mother would abruptly put a stop to it by suddenly knocking both of the contestants completely out of time. In fact, as they grew apace, the parental visitations increased so rapidly I began to fear she would put an end to my bear investigations by chastising the lives out of them, but of late she has slackened in her attentions and I am in hopes of following the growth of *Ursus americanus* from babyhood to adolescence."

Black bears seem to be omnivorous at all times. During the early spring the main source of sustenance appears

to be roots. Presently come along berries and for animal food, ants, crickets, grasshoppers, water insects. Strawberries, blueberries, and raspberries are all acceptable. Old logs and stumps are torn open and the ants commonly found there devoured. All bears are passionately fond of honey and are quick in ferreting out probable bee trees. When a bear discovers a bee tree, he attacks it vigorously with teeth and claws. Except on the nose and mouth of the bear, the enraged insects have little power to penetrate his tough hide. The honey he devours ravenously, perhaps finding a little additional spice in the bees that still cling thereto.—(S. & C.)

In August they devastate cornfields, and in September and October they gather nuts, acorns, wild grapes, and mushrooms. In many sections in early days they were reported to have developed a taste for pork and to have shown astonishing boldness in breaking into pig pens and making off with the young porkers.—(S. & C.)

Bears are also quite mischievous and many tales are current of depredations round camps, tents torn down, blankets and instruments scattered about, depredations in which hunger scarcely could have played a part. An amusing story is told of a bear cub who would face and fight practically anything known. But a wheelbarrow always seemed to him an unknown and dangerous article. A small boy armed with a wheelbarrow could drive this cub wherever he chose. This young Bruin, on mischief bent, entered a house while the occupants were absent, and deliberately tore to shreds all the bonnets in a wardrobe, an exploit which caused his prompt undoing.

A black bear is a good climber and a good swimmer as well. Those who have only seen bears slouching about a

cage will be surprised at the quickness with which a black bear will climb a tree. He can scarcely command the spring of a squirrel or marten, but he will go much faster than a man and quite as nimbly as a monkey.

Bears have been known to take apparently voluntary long swims across Northern lakes and rivers. Bears also swim slowly about, with open mouth, feeding on water insects and May-flies. The bear on seeing a man in an open boat is inclined to turn and join forces by climbing in; but his idea of equilibrium will probably result in the overturn of the other occupant, unless his progress be halted with a rifle shot.

All wild animals labor diligently in the autumn to store up, either on their own persons or externally, supplies of fat against the time of deep snows and thin rations. The black bear is loath to quit the delights of forage and will not do so, be the weather ever so severe, provided food supply is still available. In open winters the males are thought to prowl about without denning and the female remains out till maternal impulse prompts her to seek a shelter for her prospective offspring. The bear is one of the best protected of the forest race, its thick coat and solid layer of fat being almost cold proof. Indeed, the black bear for short periods does not trouble to fix up any retiring den whatsoever, merely crawling into any convenient shelter. Fresh snow will complete the covering and as breath condenses and freezes, an icy wall will be formed from which the animal will not be able to emerge until the warm sun breaks his shell.

An Adirondack guide is reported to have had the good luck to see an old bear when it first emerged in the spring. He and his partner were log driving and, as they sat on

the bank waiting for the drive, an enormous black bear appeared on the opposite side of the stream. It gazed stupidly at them, sniffed, walked to the water within thirty yards of the loggers, and drank long and greedily, so that its front legs seemed tired of stooping. Presently it straightened up, sniffed, gazed, and again drank heavily. Three times it did this, till it seemed distended with water. Then it crossed the stream, still sniffing and gazing in a dazed fashion, and walked past the men. They noticed that it was an enormous bear and that its cheeks were grizzled. The trail of this bear led back to a huge hollow pine and there ended. Evidently they had seen the bear taking its first drink.

A captive bear that has lost his fear of man and through cruelty begotten a hate of him; a female whose young are threatened; and a crippled or disabled animal, will fight, and fight vigorously; but except under such special circumstances there is little need to fear the black bear. But when it so desires, this muscular animal will make a very dangerous antagonist. A blow of its paw will disable man or dog, and a snap of its jaws will crush ribs and limbs. Its sharp claws become powerful weapons and, legend to the contrary, man has no chance against the black bear unless he fight with the modern artifice of shotguns.

The bear is well up in the scale of intelligence, though it cannot compare with dog, fox, or wolf. Powers of smell and hearing are acute and its suspicion of all things new and strange saves it again and again from troubles more or less serious. A bear feeding at a distance of half a mile will throw up his nose at the scent of the hunter, then disappear into the wood, not to resume feeding till miles

away. On the other hand, his eyesight is not good and in the right wind the hunter will frequently be able to approach quite near.

A young but full-grown animal fattened on grains, roots, and berries is said to be excellent food; but an old bear, tough and lean, killed after long pursuit in hot weather, will be found to be little better than poison, which even dogs will decline.

PART IV

INSECTIVORA

(BURROWING ANIMALS)

INSECTIVORA

(BURROWING ANIMALS)

The animals of the order INSECTIVORA are distributed over all parts of the world except Australia. The shrews and moles are our North American representatives and make up the bulk of the order throughout its range.

The moles burrow in the ground. The shrews live in burrows and also on the surface. Our American species are all very small, covered with very soft silky fur; teeth bear considerable resemblance to those of the CARNIVORA; eyes are small and rudimentary. Shrews and moles are mainly insectivorous though some species vary their diet.

—(S. & C.)

I

SHREWS

Family *Soricidae*

Shrews are all of small size, some of them being the most minute mammals known. The fore feet are similar to the hind ones, not modified for digging. The appearance is mouse-like, but with a much more slender-pointed snout.

They form three well-marked groups: the short-tailed shrews, the long-tailed shrews, and the marsh shrews.

—(S. & C.)

Anatomically the shrews are as different from the mice as a small badger is different from a big gray rabbit. Striking peculiarities are the absence or apparent absence of eyes and ears, the long sharp nose, and the teeth.

If we examine the teeth of a shrew we will find in the upper jaw three kinds: first, a pair of large protruding incisor teeth in the front, almost tusks when we consider the size of the shrew; second, three large teeth (molars) on each side in the back of the mouth; and third, four or five simple pointed teeth on each side, situated between the other two. These last are unicuspid, or single pointed, and furnish the best aid in distinguishing the little animals.

—(S. & C.)

1. Common Shrew

Sorex personatus (I. G. St. Hilaire)

(Also called *Long-tailed Shrew, Cooper Shrew, Masked Shrew, Shrew Mouse*)

Length—3.75 inches.—(S. & C.)

Description—Small and slender, with a long pointed snout

supporting long "whiskers." Tail nearly as long as the head and body. Dark brown above, hairs slaty at their base, brighter on the rump, and shading gradually to gray on the underside.—(S. & C.)

Range—Canada to Indiana and southern New Jersey, and in the Alleghanies to North Carolina.—(S. & C.)

A common mouse looks overgrown and clumsy beside the smaller varieties of the mouse shrew. Shrews are active throughout the winter. The crevices of bark and the dark interiors of hollow trees provide them with the insects on which they live. With the single exception of some of the weasels they are probably the most energetic, excitable little beasts alive.

The favorite surroundings are grassy tangles and brushy labyrinths near water. The shrew mouse has been described by Merriam in words that have become almost a classic:

"The naturalist well knows that, however cautiously he may walk, the stir of the footstep puts to flight many forms of life that will reappear as soon as quiet is restored; therefore, in his excursions through the woods, he waits and watches, frequently stopping to listen and observe. While thus occupied it sometimes happens that a slight rustling reaches his ears. There is no wind, but the eye rests upon a fallen leaf that seems to move. Presently another stirs, and perhaps a third turns completely over. Then something evanescent, like the shadow of an embryonic mouse, appears and vanishes before the retina can catch its perfect image. Anon, the restless phantom flits across an open space, leaving no trace behind. But a charge of fine shot, dropped with quick aim upon the next

leaf that moves, will usually solve the mystery. The author of the perplexing commotion will be found to be a curious, sharp-nosed creature no bigger than one's little finger and weighing hardly more than half a dram. Its ceaseless activity and the rapidity with which it darts from place to place is truly astonishing, and rarely permits the observer a correct impression of its form."

These tiny creatures run about by day and by night. Their rudimentary eyes tell them when they emerge from shadow to sunlight, but can hardly be strong enough to be of much further assistance. When trapping for large animals with meat bait, traps are many times found sprung with no trace of the meddler. In many cases this is probably done by shrews. This species spends its life above ground; its home-nest will be in a sheltered spot not too far from the level of the earth. Whenever a large tree or limb falls to the ground in the woods shrews will quickly examine every part with care. If cavities or knot holes are discovered, the inquisitive shrews quickly take possession.

We have almost no information as to the mating of these tiny animals. Quite probably the species mates and multiplies with little regard to season. All evidence points to their being decidedly cannibalistic. Whenever two or three are caught and confined together, the stronger invariably attacks and devours the weaker.

The appetites of shrews are enormous and their digestion rapid. They probably eat their own weight of food every twenty-four hours and, as they do not hibernate or lay up winter supplies, the frantic way they move about under the snow in winter is easily explained. In Alaska the first severe weather brings them about the trading stations

where they forage and penetrate every corner of the houses with the vigor and persistence of the domestic mouse.

The Norton Sound Eskimo have a curious superstition that there is a water shrew living on the ice at sea that is endowed with demoniac power to do harm. This shrew, according to the Eskimo, will dart at an intruder and burrowing under the skin, work about at random till it reaches the heart and kills him. Eskimo hunters are in mortal terror if they chance on a shrew at sea and will stand on the ice several hours immovable until this small animal disappears from sight. Such is the power of superstition!

The human ear can hardly catch the high-pitched squeak by which this small animal communicates with its fellows and expresses its probably not very complex emotions. The sound is compared by Herrick in his "Mammals of Minnesota" to "the lower notes of an elfin symphony, the upper registers in which were beyond the powers of human ears to distinguish. Without moving, I turned my eyes upon the fire-lit circle, about which the darkness formed an apparently impenetrable wall. Only the most careful scrutiny enabled me to discover the tiny musicians. Within a few feet of my head, upon a decayed log, raced a pair of shrews. Up and down they ran with the most sprightly motions imaginable, twittering incessantly."

Against the larger animals who kill the shrew for food or sport, the animal has developed a strong protective smell that, alas, helps it little in life, but usually protects it from being used as food. Hawks, owls, weasels, and minks all kill the shrew, but do not, except in desperate straits, care to partake of the flesh.

There are many varieties of small long-tailed shrews which may conveniently be grouped as follows:

Group A. *Length 3.80–4.60 inches. Five unicuspid teeth, tail less than 1.80 inches:* Common shrew, *S. personatus* (Geoffrey); Labrador shrew, *S. personatus miscix* (Bangs), larger, paler, and grayer; smoky shrew, *S. fumeus* (Miller), larger than common, dark slate colored; Southern shrew, *S. longirostris* (Bachman); Fisher's shrew, *S. fisheri* (Merriam).—(S. & C.)

Group B. *Tail very long* (2.20 inches) *and heavy:* Long-tailed shrew, *S. macrurus* (Batchelder), easily differentiated by the very thick tail with a pencil of hairs at the tip.—(S. & C.)

Group C. *Very small, length 3.20–3.40 inches. Apparently only four unicuspid teeth on each side, the third being exceedingly small.* Hoy's shrew, *S. Hoyi* (Baird). Brown above, shading to gray beneath, a touch of fulvous between the front legs. The smallest North American mammal.—(S. & C.)

II. Marsh Shrew

Neosorex palustris (Richardson)

(Also called *Water Shrew, Black and White Shrew*)

Length—6⅛ inches.

Description—All above dusky brown, or very dark gray, sprinkled with hoary; below white, silvery in some lights; tail bicolored, blackish above and all around near tip, white below. The general impression is of a large, long-tailed shrew, black above, white below.

Range—From Minnesota west to the mountains and through lower Canada. On both Atlantic and Pacific coasts the varieties are slightly different.

The genus *Neosorex* is much like *Sorex*, but differs in having greater size, different color pattern, and peculiar feet; these, somewhat like the feet of the muskrat in miniature, are well adapted for swimming.

Marsh shrews inhabit the borders of streams and marshes. The Indians are reported to have called this shrew the beaver shrew, because it was frequently found in beaver lodges during winter.

Very little accurate information is available regarding the habits of this small animal. It seems reasonable to infer that the marsh shrew nests in a hole in a bank by the water, swims and dives with ease, catches insects and mollusks, leads generally the life of an otter; but until the marsh shrews are studied scientifically we cannot be sure of even these simple facts.

III. Short-tailed Shrew

Blarina brevicauda (Say)

(Also called *Mole Shrew*)

Length—5 inches.

Description—Rather short, tail short, about one quarter the length of the head and body. Sooty plumbeous, slightly lighter below; varying in depth in changing light as the fur is disturbed. Front teeth chestnut colored at the tips.

Range—Atlantic States to Nebraska, south to Ohio, Maryland, and the mountains of North Carolina. Replaced southward by slightly different varieties.

The shrews and moles may be arranged in a scale corresponding with their degree of comparative blindness as follows:

1. The long-tailed shrew that prowls in labyrinth and thicket but rarely digs.

2. The blarina that hunts still lower, in moss, fallen leaves, loamy soil.

3. The star-nosed mole that digs in moss, softer mould, and occasionally in mud.

4. The true mole that tunnels in the ground unceasingly.

The mole shrew partakes of the habits of both the mole and the shrew. Sometimes they burrow along under the turf, which they push up in low intersecting ridges. And again they spend much of their time running along the shady stone walls or skipping about over fallen leaves. It is to be conjectured, at least, that the mole shrew prefers the open air, resorting to burrowing only when open-air supplies fail.—(S. & C.)

These are obstinate, savage little brutes, in character somewhat like weasels. They scent meat at great distances* and eat ravenously any that may have been left by larger animals. Quite frequently young mice and the young of ground nesting birds are attacked by them. Though mostly insectivorous from necessity, being the smallest of beasts, they are still carnivorous by taste and preference.—(S. & C.)

Favorite localities are tangles of brush and sedgy grass, under log piles, along streams. Less aquatic than other members of the family, the blarina is still a liker of water and is probably always to be found with streams or ponds at not too great distance away.

The furrowed, twisted trail that the blarina leaves in

*There seems to be a conflict of opinion as to this. Mr. Seton says "it [the short-tailed shrew] does not smell well."—EDITOR.

the snow expresses perfectly its life beneath the leaves of the wood. There is evidence that the species prepares a nest for the young with some care. A blarina gallery may be one to two inches down, one and a quarter to two inches wide, and extended indefinitely according to caprice.

Such meagre evidence as we have would lead us to believe that the shrews pair and that the male abandons the nest for a time on the arrival of the young. It is quite likely that two or three litters will be borne within twelve months.

The blarina has an enormous appetite and in captivity will die within a few hours if deprived of food. Dormant insects must apparently sustain it during the winter as it does not hibernate. Experiments made in Ann Arbor, Mich., by A. F. Shull prove that in winter the blarina often feeds on snails and that it gathers these into heaps, keeping them alive above ground and in underground dens. Merriam suggests that the shrews eat and collect nuts and grains to help them out over winter. Certainly insects alone seem too precarious to be relied upon. Yet if a blarina chance on a fat colony of mice with ample stores, he may live a month in the greatest luxury!

We humans are unable to make much success in differentiating the cries of bats and shrews; they both sound like a sharp, high-pitched twittering, or a screech "as sharp and fine as a needle." Kennicott studied a captive mole shrew: "When hurt or irritated, it uttered a sharp, tremulous note like *zee-e* and when it was much enraged this note became longer, harsher, and twittering, like that of some buntings or sparrows. Sometimes a short, clear cry was uttered, the voice calling to mind that of the common mink (*Putorius vison*), but softer and lower.

The strength, ferocity, activity, and courage of this

little animal are extraordinary and make it a terror to the wild creatures of its small world. Yet the blarina is practically blind, does not smell keenly, is in many ways vulnerable. Hearing and touch make up for these deficiencies by being superlatively fine, and the blarina will attack successfully any animal up to double its own weight.

Kennicott made many interesting observations on captured blarina which on account of their length we must greatly summarize. "While alive, the minute black eye is distinctly seen and always open; but though the sense of sight may be possessed in the dark it is certainly not used in the full light. Upon waving different objects before one, or thrusting my finger or a stick close to its face, no notice was taken of it whatever: but if I made a noise near by, it always started. An exceedingly delicate sense of touch was exhibited by the whiskers and if, after irritating a shrew, I placed a stick against it, in even the most gentle manner, the animal would instantly spring at it. I could see that in running along the floor it stopped the moment its whiskers touched anything; and often, when at full speed, it would turn aside just before reaching an object against which it seemed about to strike and which it certainly had not seen."

Caged specimens, both male and female, showed great pugnacity. Motions, when angry, were characterized by peculiar firmness: muscles appeared to be held very rigid; movements were made by quick, energetic jerks. Short springs, backward, forward, or sidewise, were all made with equal readiness. When attacked by a meadow mouse, the blarina did not pursue its adversary when the latter moved off, nor did it even retreat.

Doctor Merriam found that a small blarina weighing

11.20 grammes could tire out and overcome a vigorous deer mouse weighing 17 grammes. The mole's method of attack was to seize the mouse in the neighborhood of the throat. The mouse would strike at and usually knock the mole away with its front feet; when the latter got a hold, it would try to bite, and they would both tumble about like dogs in a fight. A shrew would never be able to catch mice on open ground; but his small size will enable him to enter into mice holes along which he would be able to follow his prey into the remotest ramifications of their burrows.

The disagreeable musky smell the little animals emit when frightened serves them in good stead, and it is not believed that many animals (owls, hawks, and weasels are exceptions) care to include the blarina in their diet. Foxes and the domestic cat often kill them either for sport or through mistaking them for the more edible meadow mice. Foxes bring them home for the cubs to play with in midsummer, but probably do not consume them for food except in the desperate pinch of midwinter.

Careful observations tend to the conclusion that this voracious little animal eats twice or three times its own weight of food every twenty-four hours. As their principal sustenance consists of insects and blarina are themselves fairly plentiful, it is staggering to think of the number of insects disposed of by these scavengers in the course of a year.

Certainly the farmer should never allow himself to be enlisted against the blarina. The animal may take a little grain at times and some of the bugs that it disposes of may be bugs that serve useful purposes; but its favorite food, which it prefers to all others, is mice; and for this reason it is the farmer's friend and should be protected.

II

MOLES

Family *Talpidae*

I. Common Mole

Scalops aquaticus (Linnaeus)

(Also called *Naked-tailed Mole*)

Length—6.40 inches.—(S. & C.)

Description—Hands large and naked with powerful nails; hind feet small; snout long and pointed; tail short and naked. Fur glossy silvery gray, varying in shade when disturbed or placed in different light; often tinged rusty. —(S. & C.)

Range—Southern Canada, southward in the lowlands to Florida, where it is represented by the somewhat smaller Florida mole.—(S. & C.)

The family *Talpidae*, or moles, are like the shrews in their soft velvety fur, their apparent lack of eyes, ears, and neck, their scanty-haired, scaly tails, and also in the general style of their teeth; but they are much larger than the shrews and have the front feet enormously developed for digging.

This is the species that is responsible for the little heaps of new dirt that are thrown up each recurring summer to deface lawns and to enrage gardeners.—(S. & C.)

The American mole is said to construct true mole hills

similar to those of the more famous Old World species. A real mole hill is an ingenious arrangement of galleries in the hard-packed earth surrounding a nest chamber. Two galleries encircle the chamber at a distance of a few inches, one above the other; short passages assure a quick and certain means of retreat in any direction. There is usually a main roadway which is an extended passage used by all the individuals of a colony in going from the nest to their diggings.—(S. & C.)

The method of procedure of the mole is as follows. Earth is dug away with fore paws until it comes within reach of his hind feet, with which he kicks it still farther back. When as much has been gathered as can possibly be pushed, the load is conveyed to the last opening made to the surface. By the time he has tunneled a yard or so from his dumping place the exertion becomes too great and the mole opens up a new outlet. Digging and sleeping consume practically all the mole's time.—(S. & C.)

Work is customarily carried on at a depth of five or six inches, but in winter the mole avoids the frost by digging much deeper. In the spring, and perhaps again in the autumn, the litter of young moles is produced in the warmly lined central chamber.—(S. & C.)

The commercially valuable fur is thick and soft. The hairs may lie forward or backward. Moleskin is light in weight, warm, but the wearing quality is poor. Bluish-gray pelts are most in demand, but black, brownish-black, and pale ones all find a use. Undressed pelts bring only a few pennies, but the expense of working up is heavy.

II. Star-nosed Mole

Condylura cristata (Linnaeus)

Length—6.80 inches.—(S. & C.)

Description—Dark brownish gray, paler beneath, tail long and hairy—sometimes very thick at the base. Snout with a remarkable naked appendage, somewhat resembling a star.—(S. & C.)

Range—Northern North America, south through the Middle States and farther in the mountains.—(S. & C.)

The star-nosed mole is the aquatic member of the family and spends its life pushing extensive tunnels through the soft black loam of swamps and along the borders of little brooks and ponds. This mole feeds principally upon worms and whatever else of insect life it comes across in its underground rambles; no doubt, also, fish, eggs of small reptiles, and the flesh of small, warm-blooded creatures are equally acceptable.—(S. & C.)

The star-nose is thought to feed only on insects and worms, eschewing seeds, roots, and all things vegetable. The animal seldom gives any sign of its presence, living below deep layers of moss. It is the least "molish" of its race, preferring swimming to digging. The few specimens taken alive have mostly been caught in open water. The animals, however, are known to live in colonies and the discovery of the location of a colony is likely to be productive of excellent results. Merriam at one time captured eight star-nosed moles in one colony.

The species is supposed to pair. Audubon and Bachman discovered a nest containing three young that were apparently about a week old. The number of the young

has been set at from four to six, and two or more litters are thought to be produced each season. The nest discovered by Audubon and Bachman was approached by a long winding burrow and situated in a large excavation under a stump; this nest was "quite spacious and composed of withered grasses."

Detailed observations were made on a star-nosed mole captured at Cos Cob, Conn., in July, 1909. The animal swam swiftly in deep water, progressing with the sculling action of his tail, also with his four feet striking alternately, never by striking both hind feet at once. He did not dive, and endeavored to get out of water as quickly as possible. He climbed fairly well when helped by wire netting, but rough boards completely baffled him. In the middle of the day he curled up and slept a couple of hours. At night he was very active. He would dive again and again through a pile of dirt in which were many earthworms, suggesting an otter diving in a salmon river.

"As soon as the above-named captive was caged I gave him twelve grammes of common worms. He paid no heed for half an hour, but then aroused himself and fell on the worms with great demonstration, continually twiddling them with his twenty-two nose fingers. Though avid, he ate them slowly, holding them with his fore claws and tearing them up before devouring. In half an hour all were gone. This was at noon; at 1:45 he seemed ravenous again. I gave him a similar amount of worms, also three cutworm grubs. These latter he ignored while the former lasted. Toward night I gave him about two ounces of raw beef of which one third only was lean, the rest fat. In the morning all the lean was eaten and all the fat rejected."

Nocturnal creatures quite frequently like to bask in the sun at midday. The star-nose is an exception, preferring the ways of darkness at all times. Almost none of the animals discussed in this volume know so little of the things that are most familiar to us and to other creatures that love the sun-warmed air and the sky. Star-nosed moles know no more of the grass and the flowers than the moist touch of the colorless root fibres. Rare water beetles and larvæ of insects "which famous entomologists would gladly give years of study to learn more about" are doubtless commonplace matters to him, mere objects of food which he crunches indifferently between his teeth. One would hazard a guess that the star-nosed mole must get a great deal of pleasure out of eating. There seems nothing else for him to enjoy in his small world!—(S. & C.)

PART V

CHIROPTERA

(FLYING ANIMALS)

CHIROPTERA

(FLYING ANIMALS)

(S. & C.)

The bats have peculiar modifications for flight that distinguish them sharply from other animals. Fore limbs are much elongated and a thin extensible membrane stretches over this framework, connecting also with the sides of the body and with the hind legs. Another membrane stretches between the hind legs known as the interfemoral membrane. Bats also have their hind legs twisted around in such a way that the knee bends backward; this makes it difficult for them to walk, a mere flopping shuffle resulting from their best efforts.

In their general anatomy and dentition bats are closely related to the moles and shrews, from which group they are often regarded as a highly specialized offshoot. These graceful flying animals are distributed through all parts of the world and vary in size from bats no bigger than a mouse to the big Malay varieties, the expanded wings of which may measure as much as thirty inches from tip to tip.

Bats are nocturnal in habit and are commonly active at dusk and just before dawn. Daytime hours are spent in slumber, hanging head downward by their hind feet in some dark cave or hollow tree. The majority of the species are insectivorous, including our common North American bat.

Our American bats represent three families of which only the common bat (Family *Vespertilionidae*) are sufficiently numerous to be included in this volume.

I

BATS

I. Little Brown Bat

Myotis lucifugus (Le Conte)

(Also called *Blunt-nosed Bat*)

Length—3.40 inches.—(S. & C.)

Description—Fur above, glossy brown; paler and more yellowish below; wing membranes naked except a narrow strip near the body.—(S. & C.)

Range—Whole of North America east of the Rocky Mountains. Covering the same range there is a very similar species, Say's bat (*M. subulatus*), with thinner membranes, longer ears, and narrower skull.—(S. & C.)

The family *Vespertilionidae* have simple noses, that is, without leaf membrane, turbinal bones folded; palate deeply notched in front; molars with W-shaped cusps; tail long and enclosed to the tip in a membrane or tail web.

In spite of their general abundance in all parts of the country we really know very little of these small, warm-blooded, furry inhabitants of old buildings and hollow trees. Awake no more than four of the twenty-four hours of the day, they make no nests and do not even attempt to line or pad the crannies where the little bats are born. —(S. & C.)

This is the common species of the Mammoth Cave of Kentucky. Caves are probably preferred locations, but

hollow trees and farm buildings prove acceptable substitutes. The species is gregarious and to some extent sociable. In flight the little brown bat is to be distinguished from others by small size, early evening appearance, and an erratic course in the air.

The firm low squeak of the bat, finer than that of the mouse, may occasionally be heard by those with acute ears when bats are flying close overhead. If captured, a bat utters a volley of these squeaks, varied with a hissing sound. Probably bats have a variety of sounds to express varying emotions, but all keyed too low for our dull ears to differentiate.

In late August and early September these graceful flyers are often seen in unusual numbers rushing about and chasing each other to and fro. This is supposed to be the mating season, about which our information is quite meagre. Gestation is unusually long, extending apparently over a period of ten months.

From observations made on a captive bat in France we have learned facts regarding the young bats. It is the habit of the mother to carry her young along with her as she flies, attached to the teats, until the offspring is about two weeks old. During the second period the young remain at home and are fed by the mother. When about three months old they fly and forage for themselves.

All our bats are thought to be exclusively insectivorous. Bats capture insects either on the wing or by picking them off flowers and twigs. The British long-eared bat, a cognate species, feeds on moths and the larger insects. "When capturing its prey," according to J. G. Millais, "the long-eared bat uses the interfemoral pouch as a trap or bag in which to hold its captive until it is firmly

gripped." All bats are heavy drinkers, going twice a day at least to the water.

When the bat is preparing to sleep, it begins to doze, gradually nodding and ceasing to look about. Presently the head hangs straight and the whole animal commences to shiver. Soon this motion ceases and the bat is asleep. The bat's toilet has been described by Stone and Cram:

"One near the middle of the row was wide-awake: washing himself after the manner of a cat, he would lick his foot, or a portion of his wing, and rub his head with it the wrong way of the fur, and scratch himself rapidly behind the ear with one of his little thumb nails at the bend of his wing, the long bone of his forearm beating a tattoo on the glass beside him as he did so. The elasticity of the wing membrane is truly astonishing; he would seize an edge of it in his mouth and stretch it into all kinds of grotesque shapes in his endeavor to get it clean enough to suit his fancy, and sometimes, when at work on the inside, he would wrap his head up in it entirely, the thin, rubbery stuff conforming to the general outline of his skull in the most startling manner."

There seems to be no reason why bats should not migrate, as do the birds, with the change of seasons, and some evidence has accumulated to this effect. Undoubtedly they torpify during frosty weather, but it is quite probable that they take advantage of the first warm weather to arouse themselves and wend their way southward.

The bat's mastery of the air is perfect. He skims, darts, turns as he wishes, all in absolute silence. The only bird that can approach him in noiselessness is the slow, lumbering owl. The bat's sense of touch is one of the most extraordinary of animal powers.

The papillæ of touch are extensively distributed along the enduplication of skin which covers the bones of the extremities. In 1793 Spallanzani made his famous experiment of putting out the eyes of a bat. Blinded bats were found capable of avoiding even the most delicate obstacles—silken threads stretched across a room. When these threads were placed closer together the bats were noticed to contract their wings so that they might pass between them without touching. They were also able to suspend themselves on the wall precisely as if they could see.

The experiments have been repeated by later observers with others still more astonishing, though with the more humane method of covering the eyes with adhesive plaster. In experiments reported by Millais, when the hooded bat wanted to rest, it settled on one of the weights of a gas chandelier in quite an orthodox manner, and when a hand was stretched out to capture it, it flew off again before it was touched. The general explanation as given by Cuvier and others is that "the waves of air set in motion by its wings reacted against their acutely sensitive surface in proportion as it approached the solid object from which these had recoiled, and thus the creature had timely warning."

Some have thought that the unusually developed ears had much to do with such unusual powers, but later evidence goes to show that the bat has special, highly sensitive nerve endings in nearly all parts of the skin and that these endings are the source of his unique gift.

With the secluded lives they live by day bats have little to fear from prowlers, and their speed is sufficient to preserve them from others that fly by night. The great

generation of animal heat in their close haunts makes them very susceptible to vermin of all sorts, including the common bedbug. Country superstition, in which there is at least some basis in fact, is to the effect that bedbugs are brought into dwelling houses by bats.

Besides *lucifugus* there is another species, *subulatus* (Say) of such close resemblance that it was not till recently that the two were marked as distinct. The range is about the same, but *subulatus* is a much rarer bat. The ears, when drawn forward, do not reach the end of the muzzle in *lucifugus*, while in *subulatus* they overlap it by $\frac{1}{16}$ to $\frac{3}{16}$ of an inch.

II. Silver-haired Bat

Lasionycteris noctivagans (Le Conte)

(Also called *Silvery Bat*, *Black Bat*)

Length—4 inches. *Expanse of wings*, 9 to 11 inches. —(S. & C.)

Description—Interfemoral membrane sparsely haired. Fur dark brown or black with silvery-white tips. Ear short and rounded.—(S. & C.)

Range—North America, south throughout Pennsylvania and the southern Alleghanies.—(S. & C.)

In addition to family and subfamily characters the genus *Lasionycteris* has short broad ears, broad tragus, and partially furred tail flap.

Bats, and particularly this variety, are the only mammals in America that range from the Atlantic to the Pacific in a belt a thousand miles wide without splitting up into several races. The young alone possess the perfect silvery

tips to the hairs from which the species derives its name.

The bat family have a decided liking for water, a trait in which the silver-haired variety shares to the fullest extent. Merriam remarks that in some places its habit of keeping directly over the water is very marked. "I have stood, gun in hand, on a point on the east bank of the river (Black River, N. Y.) and have seen hundreds passing and repassing, flying over the water, while during the entire evening not more than two or three strayed so far that, if shot, they would fall on the land."

No information is available as to the individual range of the silvery bat, or, indeed, on any of the bat family, but we have every reason to believe that with their marvellous flying equipment they range far and wide. They seem to be subject to excessive fluctuations in numbers, for reasons of which we have as yet not even a clew. In Winnipeg, for instance, this bat is reported to have been plentiful in 1905 and 1906, but only one was reported all through the season of 1907. On the Eastern coast we have record of the silver-haired bat occurring in great numbers in various islands for comparatively short intervals and then moving on. Such facts point to regular migrations, but we are as yet without the information required to trace a route or to define limits.

All the bat family except the hoary bat are known to gather in large numbers when circumstances are favorable. In the famous roosting place at Seneca Point, Maryland, mentioned in Allen's Monograph, where bats had taken possession of abandoned property, 9,640 bats by actual count were killed, besides nearly 2,000 not included before the colony was extirpated.

All the bats are crepuscular and a comparative table

would show the family making an evening appearance in the following order: little brown bat, red bat, silvery bat, big brown bat, hoary bat. If the sun be considered as setting at eight o'clock, the little brown bat might appear as early as seven o'clock, and the hoary bat not till nine-thirty or ten. Moonlight will have a modifying effect on the time of their appearance.

"In the early dusk the silver-haired bat emerges from its hiding place. After a few turns about the immediate neighborhood it generally takes a pretty direct course for water. I have seen it start from the summit of a high, densely wooded hill, circle round for a few minutes, and then, keeping far above the tree-tops, sail leisurely toward a distant river till lost from sight in the valley below. And standing along the banks of the large stream that winds along the foot of this hill, I have seen the bats flying over at a height of several hundred feet, all moving in the same direction—toward a more distant river." (Merriam.)

III. Large Brown Bat

Eptesicus fuscus (Beauvois)

(Also called *House Bat, Serotine Bat, Carolina Bat*)

Length—4.60 inches. *Expanse of wings*, 12 inches. —(S. & C.)

Description—Flight membranes naked except the base of the interfemoral membrane. Fur silky, dark brown, rather lighter below.—(S. & C.)

Range—Gulf coast north to Maine and Ontario.—(S. & C.)

The large brown bat is distinguishable on account of his size, which in the uncertain twilight becomes exaggerated,

making the observer believe for a moment that he is seeing the largest and rarest of the family, the hoary bat. The large brown is one of the commonest bats through the southern United States as far north as the upper limits of the Carolina faunal belt, through southeastern Pennsylvania, southern New York, and the Connecticut Valley.—(S. & C.)

These are the last to make their appearance in the evening, says Dr. A. K. Fisher, who observed the big brown bat in the Hudson Valley. "When it gets so dark that objects are blended in one uncertain mass, and the bat hunter finds that he is unable to shoot with any precision, the Carolina bats make their appearance as mere dark shadows, flitting here and there while busily engaged in catching insects. We have to make a snap shot as they dodge in and out from the dark tree-tops, and are left in doubt as to the result until, in the gloom, we may perchance see our little black-and-tan, seemingly as interested in the result as we are, pointing the dead animal."

This is a lower flyer than either the red bat or the hoary, and displays a marked preference for town life. Open ways between trees seem especially alluring to these twilight prowlers. The environs of rivers and ponds must have confined them in early days rather exclusively, but nowadays clearances have greatly enlarged their area and in every meadow and field near sheltering groves brown bats may be looked for.

Since the introduction of electric lights along the streets of our smaller cities, bats are frequently to be seen circling about, never failing to reap a harvest of their favorite food. In summer they evince no objection to entering

houses in pursuit of flies and other insects. In late autumn and on mild evenings in midwinter they will occasionally take up temporary shelter indoors, causing great commotion on a following night when they make their presence known. Indoors bats pass to and fro with the greatest dexterity, always avoiding objects that may stand in their way.—(S. & C.)

Though this is the commonest of bats we know little more in detail regarding its habits than we do regarding others, and must fall back on such facts as are proved of the species in general. Presumably as with others the mating season is in late summer and the young bats are produced late the following spring. Food for this large-sized bat presumably differs in quantity only from that of the smaller species. Dr. R. W. Shufeldt made the following observations among others: "They drink a great deal and have simply enormous appetites. One specimen, in the course of a single night, consumed twenty-one full-grown June bugs, leaving only a few legs and the hard outside wing sheaths."

It is pleasant to add that, as far as the observations of naturalists go, this variety is to be cleared of the popular charge of bringing bedbugs and other insect vermin into houses.

IV. Red Bat

Lasiurus borealis (Muller)

(Also called *Tree Bat*)

Length—4.40 inches. *Expanse of wings*, 11 inches.
—(S. & C.)

Description—Base of wing membranes, whole interfemoral

membrane and base of the ears densely furred. Fur varying in color from bright rusty red to grayish tinged with rufous; always lighter on the lower surface, hairs generally somewhat tipped with white, and a whitish patch in front of each shoulder.—(S. & C.)

Range—Canada to Texas and northern Florida.—(S. & C.)

The genus *Lasiurus* has, in addition to the family and sub-family characteristics, the tail densely hairy above, continuous with the back furring; ear broad, low, and round-topped.

The red bat is one of the most frequently seen of the family. In most portions of the United States it would be safe to say that in any given instance of a bat entering rooms in the evening the chances are a hundred to one that it would prove to be either the red bat or the little brown. The red bat appears usually while it is still quite light and while the rufous color is easily seen. The word rufous, however, fails to convey any idea of the exquisite tints that go to make up the general tone of red. In the air its long thin wings distinguish it from all but the hoary bat which customarily appears much later in the evening.

Bats congregate in dark caves in vast numbers during the daytime, or, if caves be unavailable, lofts and garrets offer the best substitutes. In a garret described by Stone and Cram, the bats entered by cracks between the bricks and the woodwork of the gable. When a flood of light was admitted, "several hundred of the little animals were discovered clinging in a compact mass to the rough bricks and mortar of the chimney. They twisted up their ugly little faces and uttered their shrill squeaking objections,

the whole mass looking like a great tawny hydra-headed monster. Upon stirring them with a stick the air immediately became filled with bats, and there was a grand scurry for the openings under the roof, where they scattered in the unwelcome sunlight in a mad rush for another shelter."

Away from the hospitable barns and garrets that men provide, the red bat merely hangs from a branch in the deep woods. Merriam, who made extensive researches on the bats, speaks of finding the red bats "asleep in the daytime, hanging by their thumb nails to small twigs or leaf stems, within easy reach." If disturbed on such occasions they flit away to some other lowly place, apparently not at all incommoded by the brightness of the daylight.

Very little is known of details of this bat's life that may distinguish it from that of other species. It is thought that the red bat migrates for the winter season and gathers in vast numbers in caves in the southern part of its range. With its complete mastery of the air and with the winter lack of insect hordes on which to feed, there would seem to be every reason why it should adopt this course, but confirmatory details are lacking. Segregation of sexes seems also a characteristic of bat life on which more information is desired. At times when numbers have been shot from large flocks they have turned out to be all males and again all females. Perhaps the sexes separate during autumnal flights, as do many birds.

As noted in the chapter on the silvery bat, the red bat is one of the earliest of the family to appear in the evening, being preceded in point of time only by the little brown bat. Merriam reports even having killed this bat on a

cloudy afternoon while flying to and fro in pursuit of insects near the border of a hardwood grove.

V. Hoary Bat

Lasiurus cinereus (Beauvois)

(Also called *Great Northern Bat*)

Length—5.40 inches. *Expanse of wings*, 12 to 17 inches.
Description—Much larger than the red bat, but with the same distribution of fur over the interfemoral membrane. Fur mingled dark brown and light yellowish brown, more or less tipped with silvery white, white predominating below. When in the air this species may be distinguished from all by its long pointed wings, great size, and swift zigzag flight.—(S. & C.)
Range—Maine, Ontario, and mountains of New England, New York, and the Alleghanies, migrating southward in winter throughout the United States.—(S. &. C.)

This is the largest and rarest of bats. Even in the Far North they are only seen occasionally and still less frequently can specimens be secured. South of the Canadian faunal region the hoary bat should theoretically be seen during its course of migration in spring and fall, but practically seems to be even a rarer sight than in the Far North.—(S. & C.)

The great hoary bat soars high above the tree-tops of the forest where fly big moths half as big as itself and worthy of its powers. This bat is one of the last to appear in the evening and consequently its capture or even the sight of it is most difficult.

Doctor Merriam writes entertainingly of the joys of

the search for this uncommon species: "Just as the darkness is becoming too intense to permit you to shoot with accuracy, and you are on the point of turning away, something appears above the horizon that sends a thrill of excitement through your whole frame. There is no mistaking the species—the size, the sharp narrow wings, and the swift flight serve instantly to distinguish it from its nocturnal comrades. On he comes, but just before arriving within gunshot he makes one of his characteristic zigzag side shoots, and you tremble as he momentarily vanishes from view. Suddenly he reappears, his flight becomes more steady, and now he sweeps swiftly toward you. No time is to be lost, and it is already too dark to aim, so you bring the gun quickly to your shoulder and fire. With a piercing, stridulous cry, he falls to the earth. In an instant you are stooping to pick him up, but the sharp, grating screams, uttered with a tone of intense anger, admonish you to observe discretion. With delight you cautiously take him in your hand and hurry to the light to feast your eyes upon his rich and handsome markings."

In the Far North the lurking place of this rare bat has been found to be the thickest boughs of a spruce top. As far as it is known hoary bats do not gather in crowds in convenient shelters as do the smaller bats. Probably the hoary bat is solitary at all times except during the mating season.

Hoaries are certainly migratory, but we have astonishingly little information either regarding time or the extent of the swing southward. An incident has been reported of a large bat, doubtless a hoary, following a column of swallows in their flight South. But whether the hoary bat flies by day or whether, in doing so, he seeks the guid-

ance of those better likely than himself to know the way are still matters of conjecture. Bats have certainly solved the problem of flight better than the birds, and it is very doubtful whether any bird could carry her young through the air and yet catch flies for food as has been credibly reported of the red bat.

PART VI
MARSUPIALIA
(POUCHED ANIMALS)

MARSUPIALIA

(POUCHED ANIMALS)

(S. & C.)

The marsupials stand apart from all the other groups of American mammals having many peculiarities of structure and habit not possessed by any other family. They are in fact the survivors of an ancient population which was spread over the earth before the superior beasts of to-day made their appearance. At about the time that the marsupials had reached the height of their development Australia became separated from the mainland of Asia, and until the present time these curious primitive animals have flourished on this isolated continent, while almost everywhere else they have been superseded by more highly developed and more aggressive beasts.

Outside of Australia the only known marsupials are the opossums, which are restricted to South and Middle America, with the single exception of the well-known Virginia opossum of our Southern and Middle States.

The variety of Australian marsupials is very great; the largest and best-known are the peculiar kangaroos; others resemble in general form our smaller carnivora, still others recall the squirrels, while the flying phalangers are the counterpart of our flying squirrels and there is even a "marsupial mole!"

Among the many peculiarities of structure exhibited

by these animals may be mentioned especially the mode of nourishment of the young. Birth takes place when they are extremely small, very much earlier than in the higher mammals, and they are immediately placed in a peculiar pouch situated on the belly of the female where, attached to the nipples, they continue their development until able to shift for themselves. Even then they return to the pouch for shelter, for a considerable period after they can run about.

The teeth of the marsupials are more primitive than those of most of the other mammals and are generally more numerous. As might be supposed from the variation in form and size exhibited by the marsupials their diet is likewise varied, some being carnivorous, others herbivorous and still others, like our opossum, omnivorous.

As before stated we have only one group of marsupials in America, the opossums.

I

OPOSSUMS

Family *Didelphidæ*

I. Virginia Opossum

Didelphis virginiana (Kerr)

Length—27 inches.

Description—Hair long and rather coarse; general color grayish white, caused by a mingling of black-tipped white under fur with long white overlying hairs; legs brownish black, feet black, toes white; head, throat, and middle of lower parts white; ears naked, black with white tips; tail prehensile, nearly naked, black at the base, shading into dull flesh color.

Range—Southern and Middle States, except in the mountains, north to the Hudson and Connecticut valleys and to southern Illinois, not ranging north of what is known as the "Carolinian Fauna." In Florida and Texas slightly different varieties occur.

The opossum is our only representative of that remarkable class of beasts in which the young are born at such an early and undeveloped stage that the mother is obliged to carry them about in her pocket for several weeks; when first born a kangaroo, an opossum, and a mouse are of very nearly the same size, about half an inch in length.

A mother opossum takes her half-dozen or more infants as fast as they are born and drops them into her pouch, where each seizes a teat and holds on; its mouth, which at first is open almost to the angle of the jaws, rapidly contracts and grows together when once it has taken hold of that which it is instinctively feeling for from the very first, and for the next few weeks the little family of brothers and sisters do nothing but sleep and grow, the old one forcing her milk into their mouths. In the meantime she is obliged to forage the woods for food and protect herself and her family as best she may.

At first thought one might very naturally infer that she would be at a decided disadvantage in being so very literally burdened with a family, yet on the whole she carries them but little longer than most other creatures of her size, the chief difference being that she has them where she can do pretty much as she pleases with them and in case of injury is much less liable to incur serious results.

Through the day she sleeps hidden in a hollow tree or stump, or dozes half in sunshine and half in shade among the branches.

But as daylight fades and the shadows creep through the undergrowth she goes forth to see what the night has to offer her, shuffling along among the dew-wet leaves, pouncing on a lizard here or a blundering dorbug that has chanced to up set itself in midflight, or else she follows up the shrill throbbing of a cricket and digs him out from his hiding place. If luck happens to be with her she may discover a nest full of eggs or young birds or mice; it is all one to her.

She can also climb to the top of the tallest tree in the

woods using her tail and hand-shaped feet almost like a monkey, even hanging head down by her tail and one hind foot if necessary from a branch just over a bird's nest in order to reach whatever it contains. Her prehensile tail moreover often proves useful in supporting her while she gathers grapes and persimmons and other wild fruits of the forest, and it is said that the young ones when they first come out to see what the world is like, have a way of taking a couple of turns of their own tails about that of their parent and so anchored ride safely on her back. It would seem that these youngsters are not in the habit of occupying the pouch as long as do the young kangaroos, which it is said, remain there for a space of something like eight months, growing in that time from diminutive beings less than an inch long to fairly well-formed kangaroos of ten pounds weight which thrust out their necks when their parent is grazing and crop the grass beneath them. Even after they have learned to go alone they often climb back into the pouch again to ride whenever they are tired out.

Opossums are anything but attractive or intelligent beasts. About the most marked exhibition of intelligence that they ever appear to display is their well-known trick of feigning death or playing possum as a last resort in danger. Even this has become so habitual with the species as to be almost or quite instinctive and it is doubtful if they ever knowingly pretend to be dead any more than the numerous beetles and spiders which possess the same habit.

Nature most effectually assists the possum in making the ruse successful, as anyone who has ever seen it tried is bound to admit, for the long, lean, dull-white jaws and

black withered ears and skinny tail bear in themselves the very semblance of death. And when the opossum plays possum he invariably draws back the gums from his glittering white teeth until he looks as if he might have been dead for a month; especially as his fur has at all times the faded, colorless look and loose wind-blown texture of hair that has been exposed to wind and weather for an entire season.

In cold weather opossums retire to their dens and only occasionally venture abroad when there is snow on the ground. They are members of an almost tropical race that hates the cold, and wherever winter is an actual fact they are rarely found.

"Opossums are very prolific, having two or three litters each year, each litter composed of from six to thirteen, in rare instances as many as fourteen or fifteen. The young remain with their mother about two months, and at times a brood of sucklings may be found in the pouch, while a second brood the size of rats may be seen on her back, clinging to her fur with their hands and steadying themselves by winding their tails around her tail and legs.

"The opossum somewhat resembles a little pig in his flexible snout, small black eyes, and erect ears; but he resembles the pig much more in his fondness for eating and the great variety of food that suits his taste.

"His principal diet consists of insects, wild fruits, nuts, and berries, varied with roots, reptiles, crayfish, carrion, eggs, small rats and mice, with additions of poultry, corn, sweet potatoes, and other farmyard delicacies. He is the natural enemy of the cotton rat, a destructive rodent living in vast numbers in the seaboard marshes of the Southern States. If all food eaten by a possum

during the year were divided into two piles according to its economic status in relation to the interests of mankind, there can be little doubt that the pile containing the matter, animate and inanimate, whose destruction is an advantage to us would be notably the larger."

THE END

INDEX

INDEX

Alces Americanus, 23
American Prong-horn, 36
American Reindeer, 31
American Sable, 205
Antelope, 36
Antilocapra Americana, 36
Arctomys monax, 89
Badger, 223
Baird Mouse, 108
Bat, Black, 270
Bat, Great Northern, 277
Bat, Hoary, 277
Bat, Large brown, 272
Bat, Little brown, 266
Bat, Red, 274
Bat, Silver-haired, 270
Bear, Black, Cinnamon, 236
Bear, Grizzly, 232
Bear, Sea, 150
Bears, 232
Beaver, Canadian, 96
Bison, 47
Black Bear, 236
Black Cat, 210
Black-tailed Deer, 18
Blarina brevicauda, 253
Bobcat, 157
Bovidae, Family, 44
Buffalo, 47
Cabrie, 36
Cabrit, 36
Canidae, Family, 168
Canis latrans, 183
Canis occidentalis, 176
Carcajou, 213
Caribou, Woodland, 31
Carnivora, 149
Carolina Bat, 272
Castor canadensis, 96
Castoridae, Family, 96
CATS, THE, 159
CATTLE, THE, 44
Cervidae, Family, 3
Cervus canadensis, 3
Chickaree, 65
Chipmunk, 72
Chipmunk, Little, 77
Chipmunk, Long-tailed, 77
Chiroptera, 265
Cinnamon Bear, 236
Citellus franklini, 79
Citellus richardsoni, 79
Citellus tridecemlincatus, 83
Common Mole, 258
Condylura cristata, 260
Coon, 227
Cooper Shrew, 248
Cottontail, 140
Cougar, 161
Coyote, 183
Cricetinae, Sub-Family, 103
Cynomys Ludovicianus, 94
Deer, 3
Deer Mouse, Arctic, 108
Deer Mouse, Prairie, 108
Didelphidae, Family, 285
Didelphis Virginiana, 285
Dog, The, 168
Eared Seal, 150
Elk, 3
Eptesieus fuseus, 272
Erethizon dorsatus, 130
Erethizontidae, Family, 130
Eutamias quadrivittatus neglectus, 77
Evotomys gapperi, 111
Felidae, Family, 157
Felis couguar, Felis Hermandezii, Felis Pardelis Linnæus, 161
Fiber zibethicus, 116
Flickertail, 79
Fox, Black, Cross, Silver, Red, 169
Fox, Blue, 175
Fox, Kit, 168
Gaufre, 120
Geomyidae, Family, 120
Glires, 63
Glutton, 213
Gopher, Gray (Pocket), 120
Gopher, Gray (Squirrel), 79
Gopher, Mole, 120
Gopher, Pocket, 120
Gopher, Striped, 83
Gopher, Whistling, 79
Gopher, Yellow, 79
Grasshopper Mouse, 106
Gray Wolf, 176
Great Northern Bat, 177
Grizzly Bear, 232
Ground Hackee, 72
Ground Hog, 89
Ground Mouse, Long-eared, 111
Ground-squirrel, Franklin, 79
Ground-squirrel, Richardson, 79
Ground-squirrel, Striped, 83
Gulo luscus, 213
Hare, Jackass, 141
Hare, Northern, 135
Hare, Prairie, 141
Hare, Varying, 135
Hare, White, 135
Hoary Bat, 277
Insectivora, 247

Jaguar (*Mexican*), 166
Jumping Mouse, 125
Kit Fox, 168
Lasiurus borealis, 274
Lasiurus cinereus, 277
Lasionycteris noctivagans, 270
Lemmings, 103
Leporidae, Family, 135
Lepus Americanus, 135
Lepus campestris, 141
Lepus floridanus mallurus, 140
Loup Cervier, 157
Lutra canadensis, 189
Lynx, Canada, 157
Marsh Shrew, 254
Marsupialia, 285
Marten, 205
Marten, Fisher, 210
Marmot, 89
Masked Shrew, 248
Mephitis putida, 217
Mice, 103
Microtinae, Sub-Family, 103
Microtus pennsylvanicus, 113
Mink, 200
Moles, 258
Mole, Common, 258
Mole Shrew, 253
Mole, Star-nosed, 260
Montana Grizzly, 232
Moose, 23
Mountain Goat, 56
Mountain Lion, 161
Mountain Sheep, 44
Mouse, Deer, 108
Mouse, Gapper, 111
Mouse, Grasshopper, 106
Mouse, Ground, 111
Mouse, House, 104
Mouse, Jumping, 125
Mouse, Pocket, 120
Mouse, Red-backed, 111
Mouse, Scorpion, 106
Mouse, Tree, 108
Mouse, Wood, 111
Mule Deer, 18
Muridae, Family, 103
Muridae, Sub-Family, 103
Mus Musculus, 104
Mus Norvegicus, 104
Muskrat, 116
Mustela Americana, 205
Mustela Pennanti, 210
Mustelidae, Family, 189
Myotis lucifugus, 266
Neosorex palustris, 252
Ocelot, 167
Odocoileus heminonus, 18
Odocoileus virginianus, 9
Onychomys leucogaster, 106
Opossum, 285
Oreamnos montanus, 56
Otariidae, Family, 150
Otoes alascanus, 150
Otter, 189
Painter Panther, 161
Ovis cervina, 44
Pekan, 210
Peromyscus maniculatus arcticus, 108
Peromyscus maniculatus bairdi, 108
Phoca vitulina, 154
Phocidae, Family, 154
Pine Marten, 205
Pocket Gopher, 120
Pocket Mouse, 120
Porcupine, Canada, 130
Prairie Dog, 94
Prairie Hare, 141
Prairie Mouse, White-footed, 108
Procyon lotor, 227
Procyonidae, Family, 227
Prong-horn, American, 36
Puma, 161
Putorius cicognanii, 194
Putorius longicauda, 194
Putorius noveboracensis, 194
Putorius rixosus, 194
Putorius vison, 200
Rabbit, Cottontail, 140
Rabbit, Gray, 140
Rabbit, Jack, 141
Rabbit, Snowshoe, 135
Rabbit, White, 135
Raccoons, 227
Rangifer Caribou, 31
Rat, Brown, 104
Rat, Norway, 104
Rats, 103
Red Bat, 274
Red Fox, 169
Reindeer, American, 31
Richardson Ground-Squirrel, 79
Sable, American, 205
Scalops aquaticus, 258
Sciuridae, Family, 64
Sciuropterous volans, 87
Sciurus carolinensis, 69
Sciurus hudsonicus, 64
Scorpion Mouse, 106
Striped Gopher, 83
Sea Bear, 150
Seal, Eared, 150
Seal, Fur, 150
Seal, Harbor, 154
Seals, 150
Serotine Bat, 272
Sheep, Mountain, 44
Shrew, Black and White, 252
Shrew, Common Cooper, Long-tailed, Masked, 248
Shrew, Marsh, 252
Shrew, Mole, 253
Shrew Mouse, 248
Shrew, Short-tailed, 253
Shrew, Water, 252
Shrews, 248
Silver Tip, 232
Skunk, 217
Skunk Bear, 213
Snowshoe Rabbit, 135
Sorex personatus, 248
Soricidae, Family, 248
Squirrel, Flying, 87
Squirrel, Gray, 69
Squirrel, Ground, 72
Squirrel, Red, 65

Squirrel, Striped, 72
Star-nosed Mole, 260
Swift, 168
Tamais striatus, 72
Taxidea taxus, 223
Thomomys talpoides, 120
Tree Bat, 274
Tree Mouse, 108
Ungulata, 1
Ursidae, Family, 232
Ursus horribilis, 232
Vespertilionidae, Family, 265
Virginia Deer, 9
Vole, Meadow, 113
Vole, Red-backed, 111
Vulpes fulvus, 169
Vulpes velox, 168
Wapiti, 3
Water Shrew, 252
Weasel, Least, Long-tailed, New York, Short-tailed, 194
Weasels, 194
White Goat, 56
Wolf, Brush, Prairie, 183
Wolf, Gray, Timber, 176
Wolverine, 213
Woodchuck, 89
Wood Mouse, 108
Zapodidae, Family, 125

BOOKS BY ERNEST THOMPSON SETON

WILD ANIMALS I HAVE KNOWN, 1898
The stories of Lobo, Silverspot, Molly Cottontail, Bingo, Vixen, The Pacing Mustang, Wully and Redruff. (Scribners.)

THE TRAIL OF THE SANDHILL STAG, 1899
The story of a long hunt that ended without a tragedy. (Scribners.)

BIOGRAPHY OF A GRIZZLY, 1900
The story of old Wahb from cubhood to the scene in Death Gulch. (Century Company.)

LOBO, RAG AND VIXEN, 1900
This is a school edition of number one, with some of the stories and many of the pictures left out. (Scribners.)

THE WILD ANIMAL PLAY, 1900
A musical play in which the parts of Lobo, Wahb, Vixen, etc., are taken by boys and girls. (Doubleday, Page & Co.)

THE LIVES OF THE HUNTED, 1901
The stories of Krag, Randy, Johnny Bear, The Mother Teal, Chink, The Kangaroo Rat, and Tito, the Coyote. (Scribners.)

PICTURES OF WILD ANIMALS, 1901
Twelve large pictures for framing (no text), viz., Krag, Lobo, Tito Cub, Kangaroo Rat, Grizzly, Buffalo, Bear Family, Johnny Bear, Sandhill Stag, Coon Family, Courtaut the Wolf, Tito and her family. (Scribners.)

KRAG AND JOHNNY BEAR, 1902
This is a school edition of Lives of the Hunted with some of the stories and many of the pictures left out. (Scribners.)

TWO LITTLE SAVAGES, 1903
A book of adventure and woodcraft and camping out for boys, telling how to make bows, arrows, moccasins, costumes, teepee, war-bonnet, etc., and how to make a fire with rubbing sticks, read Indian signs, etc. (Doubleday, Page & Co.)

MONARCH, THE BIG BEAR OF TALLAC, 1904
The story of a big California grizzly that is living yet. (Scribners.)

ANIMAL HEROES, 1905

The stories of a Slum Cat, a Homing Pigeon, The Wolf That Won, A Lynx, A Jackrabbit, A Bull-terrier, The Winnipeg Wolf, and a White Reindeer. (Scribners.)

BIRCH-BARK ROLL, 1906

The Manual of the Woodcraft Indians, first edition, 1902. (Doubleday, Page & Co.)

WOODMYTH AND FABLE, 1905

A collection of fables, woodland verses, and camp stories. (Century Company.)

THE NATURAL HISTORY OF THE TEN COMMANDMENTS, 1907

Showing the Ten Commandments to be fundamental laws of all creation. 78 pages. (Scribners.)

THE BIOGRAPHY OF A SILVER FOX, 1909

or Domino Reynard of Goldur Town, with 100 illustrations by the author. 209 pages.

A companion volume to the Biography of a Grizzly. (Century Company.)

LIFE HISTORIES OF NORTHERN ANIMALS, 1909

In two sumptuous quarto volumes with 68 maps and 560 drawings by the author. Pages 1,267.

Said by Roosevelt, Allen, Chapman, and Hornaday to be the best work ever written on the Life Histories of American Animals. (Scribners.)

BOY SCOUTS OF AMERICA, 1910

A handbook of Woodcraft, Scouting, and Life Craft including the Birch-Bark Roll. 102 pages. (Doubleday, Page & Co.) The Year-book of the Boy Scouts of America is now handled by the American News Co.

ROLF IN THE WOODS, 1911

The Adventures of a Boy Scout with Indian Quonab and little dog Skookum. Over 200 drawings by the author. (Doubleday, Page & Co.)

THE ARCTIC PRAIRIES, 1911

A canoe journey of 2,000 miles in search of the Caribou. 415 pages with many maps, photographs, and illustrations by the author. (Scribners.)

THE BOOK OF WOODCRAFT AND INDIAN LORE, 1912

with over 500 drawings by the author. (Doubleday, Page & Co.)

THE FORESTER'S MANUAL, 1912

One of the best-known forest trees of eastern North America, with 100 maps and more than 200 drawings. (Doubleday, Page & Co.)

WILD ANIMALS AT HOME, 1913
with over 150 sketches and photographs by the author. 226 pages. In this Mr. Seton gives for the first time his personal adventures in studying wild animals. (Doubleday, Page & Co.)

MANUAL OF THE WOODCRAFT INDIANS, 1915
The fourteenth Birch-Bark Roll. 100 pages. (Doubleday, Page & Co.)

WILD ANIMAL WAYS, 1916
More animal stories introducing a host of new four-footed friends, with 200 illustrations by the author. (Doubleday, Page & Co.)

WOODCRAFT MANUAL FOR BOYS, 1917
A handbook of Woodcraft and outdoor life for members of the Woodcraft League. 440 pp. 700 ills. (Doubleday, Page & Co.)

WOODCRAFT MANUAL FOR GIRLS, 1917
Like the foregoing but adapted for girls. 424 pp., Illus. (Doubleday, Page & Co.)

THE PREACHER OF CEDAR MOUNTAIN
A novel. A tale of the open country. (Doubleday, Page & Co.)

SIGN TALK
A Universal Signal Code, Without Apparatus, for use in the Army, the Navy, Camping, Hunting, Daily Life, and among the Plains Indians. (Doubleday, Page & Co.)

WOODLAND TALES
Delightful children's stories, of fable and fairy-tale flavor, with the wild things of the woodland for their heroes. At the heart of each some nature secret is revealed. (Doubleday, Page & Co.)

ANIMALS WORTH KNOWING
The life histories of some sixty North American wild animals written in popular language for the "Worth Knowing Series." Selected from "Life-Histories of Northern Animals." Arranged by Robert M. McCurdy, with paragraphs on classification and other excerpts from Stone & Cram's "American Animals." (Doubleday, Page & Co.)

BY MRS. ERNEST THOMPSON SETON
Published by DOUBLEDAY, PAGE & CO.

A WOMAN TENDERFOOT, 1901
A book of outdoor adventures and camping for women and girls. How to dress for it, where to go, and how to profit the most by camp life.

NIMROD'S WIFE, 1907
A companion volume, giving Mrs. Seton's side of the many campfires she and her husband lighted together in the Rockies from Canada to Mexico.

Date Due

TRINITY METHODIST CHURCH

590
S

SETON

615

NATURE LIB. "ANIMALS"

DATE	ISSUED TO

590
S-

615